MACKENZIE MOUNTAIN NON-RESIDENT AND NON-RESIDENT ALIEN HUNTER HARVEST SUMMARY 2010

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ENVIRONMENT AND NATURAL RESOURCES
GOVERNMENT OF THE NORTHWEST TERRITORIES

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ABSTRACT

Each of the eight licenced outfitters and Renewable Resource Officers with the Sahtu and Dehcho Environment and Natural Resources (ENR) Regional offices collected data on big game harvested in the Mackenzie Mountains during the 2010 hunting season. Harvest data and observations of wildlife from non-resident and non-resident alien hunters (collectively called 'non-resident' for this report) were recorded. For 2010, 375 hunters bought non-resident licences. This is higher than the average 361 (range 321-407) sold to non-resident hunters from 1991-2010. Hunters purchased more tags for wolf and wolverine in 2010 than in any previous year. Hunters (n=280) from outside Canada (non-resident aliens) were primarily from the USA (n=225) and comprised 60% of the outfitted hunters; 23, 9, and 5 hunters were from Germany, Mexico, and Italy respectively. There were 95 (25%) Canadian hunters, whose residency was from outside the Northwest Territories (NT). Of the 375 non-resident licence holders, 337 came to the NT and most spent at least some time hunting. Similar to the past 16 years, 253 tags were purchased for Dall's sheep; 193 rams were harvested (including eight by resident hunters). The average annual ram harvest over the past 20 years is 197. The mean (±SD) age of harvested rams was 10.8 $\pm$ 1.7 years, the second highest average age since records have been kept (1967) and the 23rd consecutive year the average age of harvested rams from the Mackenzie Mountains has been 9.5 years or older. Hunters reported seeing an average of 8.3 legal rams (horns at least ¾ curl) per hunt and observed an estimated 48.7 lambs and 93.2 rams per 100 ewes, respectively. The lamb:ewe ratio was lower than the average of 55.0 reported since 1995. Of 295 tags purchased for northern mountain caribou, 158 bull caribou were harvested, similar to the average of 157 (range 117-191) from the past 20 years. Hunters observed an

estimated 44.6 caribou calves, and 46.4 bulls per 100 adult female caribou, respectively. Of the 116 tags purchased for moose, 75 bull moose were harvested, matching the highest harvest (range 32-75) from the past 20 years. A moose harvested this year in the Mackenzie Mountains has the potential to be the next Pope and Young World Record moose. Hunters observed an estimated 35.3 moose calves, and 100.5 bulls per 100 adult female moose, respectively. The number of calves per 100 adult females is higher than the mean 30:100 recorded since 1995 and the tenth time in the past 16 years when the ratio has been ≥30:100. Of the 45 tags purchased for mountain goat 13 goats were harvested, 10 billies and 3 nannies. The 2010 harvest is down from that of the past three years. The mean age, determined by horn annuli of 12 harvested goats, was 8.5 years (range 4.5-14.5 years); three goats were >10 years old. Hunters observed an estimated 78.3 goat kids and 46.2 billies per 100 adult nannies. Nineteen wolves were harvested from 294 tags purchased including four harvested during hunts in April 2011, a time outside of the usual hunting season in the mountains. During 1991-2010 mean annual wolf harvest was 14 (range 7-23). Hunters observed 203 wolves in 2010, falling midway in the 142-317 range observed since 1995. Three wolverine were harvested from 171 tags purchased in 2010. Hunters observed 31 wolverine, three observations of a pair of animals and 25 observations of solitary individuals. The number of wolverine observed in 2010 continues an increasing trend from 2007, and is similar to the numbers observed during 1995-1999 and 2004-2006. No black bears were harvested from the 28 tags purchased. Only three black bears have been harvested in the Mackenzie Mountains since 1991. There has been no grizzly bear hunting season for non-residents since 1982, however a resident hunter guided by an outfitter did harvest a grizzly bear this year. No nuisance grizzly bears were killed this year, a first since 1993. Hunter satisfaction remains high; 98% of

respondents (n=193) rated their experience as either excellent (88%) or very good (10%). A number of hunters made specific comments about the high quality hunting experience, the abundance of wildlife in the Mackenzie Mountains (both game and predators), and the impressive management and stewardship of the land; 22% were repeat clients returning for their 2nd to 15th hunt in the Mackenzie Mountains, and 88% indicated they would like to return in future years. For a second year there were comments questioning the size of the Nahanni National Park Reserve expansion. Also there were some pointed comments related to the timing of the trophy and tag fee increases in relation to the hunting season. Disappointingly, we received only 60% of the voluntary hunter observation forms, returning to pre-2004 levels. Prior to the 2009 hunting season ENR worked with the Association of Mackenzie Mountain Outfitters (AMMO) to devise a better reporting system of wild game meat distribution. The new system included providing supplemental summary meat record forms to all outfitters in addition to collecting voluntary AMMO meat forms. This seems to have been an improvement, because we received information on wild game meat distribution from six of the eight outfitters this year. We will continue with this system in future. Based upon the new system we estimate that at least 15,302 kg (33,665 pounds) of wild game meat, mostly moose and mountain caribou, was distributed locally in 2010. Replacement cost of meat from local northern retailers is estimated conservatively at about $306,040, using $20/kg average replacement cost. The boundaries of Nahanni National Park Reserve were substantially expanded in 2009. The new boundary overlaps outfitting zones Ramhead, South Nahanni, and Nahanni Butte by 4.7%, 27.2% and 79.4% of the total area respectively. However, until negotiations between these outfitters and Parks Canada are completed ENR will continue to issue licences, tags, and export permits for harvesting by these three outfitters in their zones.

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The 140,000 km^2 (54,000 mi^2; 34.6 million acres) area of the Mackenzie Mountains in the western Northwest Territories (NT) was first opened to non-subsistence hunters in 1965 (Simmons 1968). Since then, the Mackenzies have become world-renowned for providing a high quality wilderness hunting experience, particularly for Dall's sheep (Veitch and Simmons 1999). In return, non-resident hunters and outfitters in the Mackenzie Mountains provide in excess of the $2.5 million estimated annually, to individuals, businesses, and governments in the NT (Harold Grinde, personal communication). The outfitted hunting industry in the Mackenzie Mountains also provides employment for 150 to 170 outfitters, guides, pilots, camp cooks, camp helpers, and horse wranglers (Werner Aschbacher, personal communication). Additionally, fresh meat from many harvested animals is provided to a number of local communities including Tulita, Fort Good Hope, and Norman Wells in the Sahtu and Wrigley, Nahanni Butte, Fort Liard and Fort Simpson in the Dehcho. This meat is distributed among local elders and residents and to health/long term care facilities. Estimated annual replacement value of this meat has ranged from *ca.* $60,000 - $300,000.

Eight outfitters are currently licenced by the Government of the Northwest Territories (GNWT) to provide big game outfitting services within the Mackenzie Mountains (Figure 1; Appendix A). No hunting is permitted within the original boundaries of Nahanni National Park Reserve (Figures 1 and 2), except for subsistence harvest by NT General Hunting Licence (GHL) holders. Under the terms of the NT *Wildlife Act*, each licenced outfitter has the exclusive privilege of providing services within their zone,

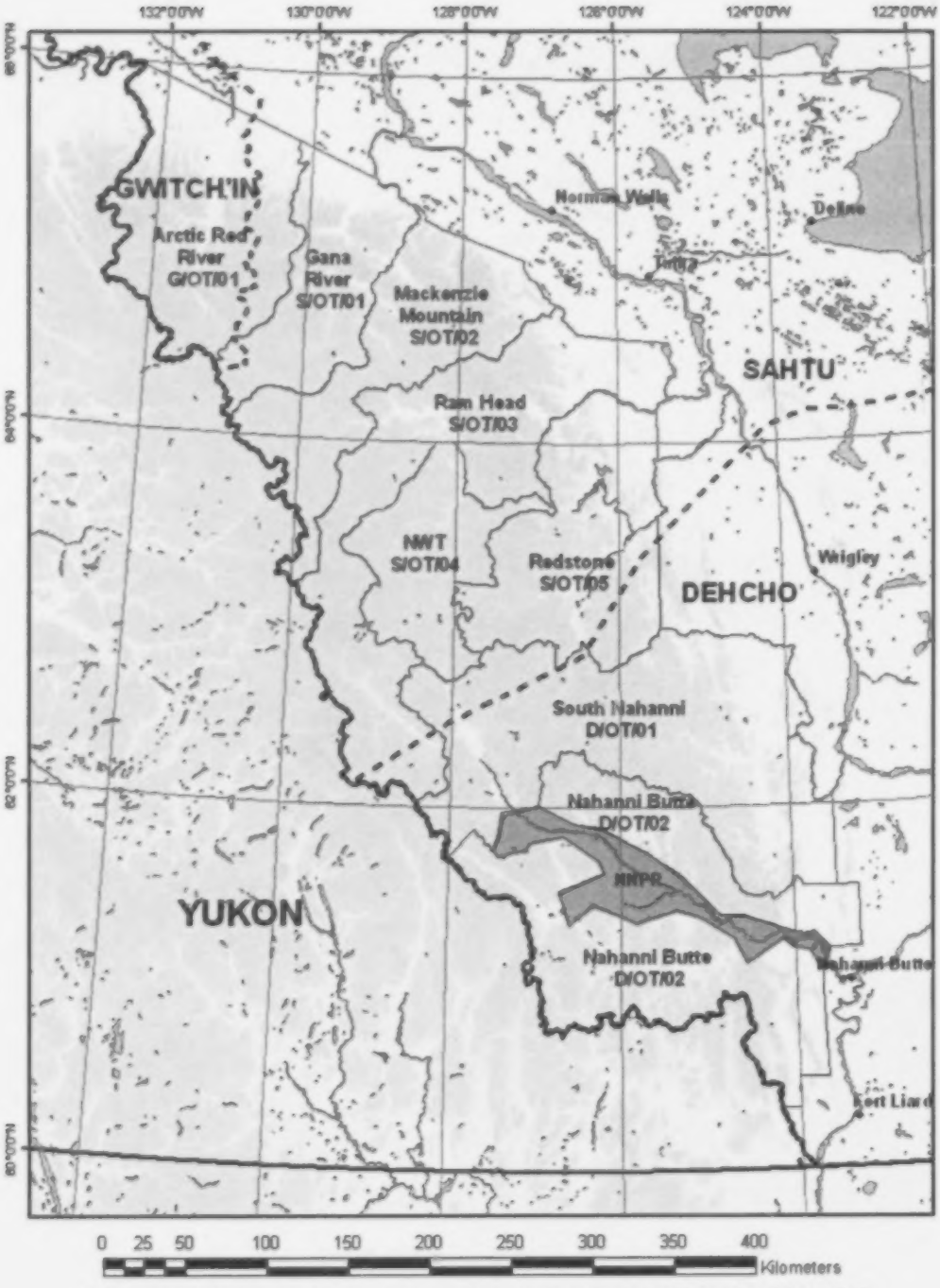

Figure 1. Outfitting zones and land claim areas (dotted lines) of the Mackenzie Mountains, Northwest Territories, with Nahanni National Park Reserve (NNPR) original boundary, prior to 2009 expansion, indicated.

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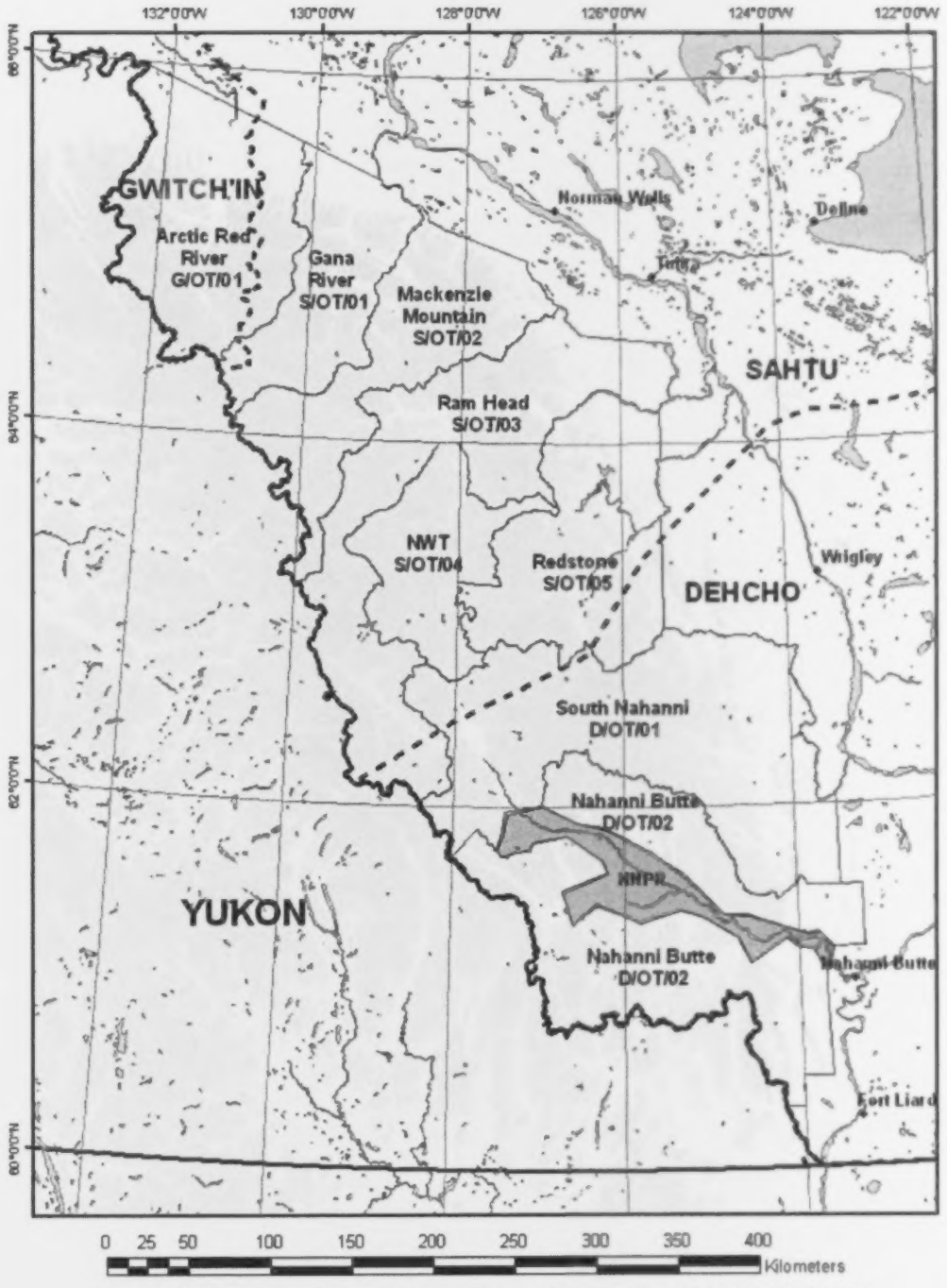

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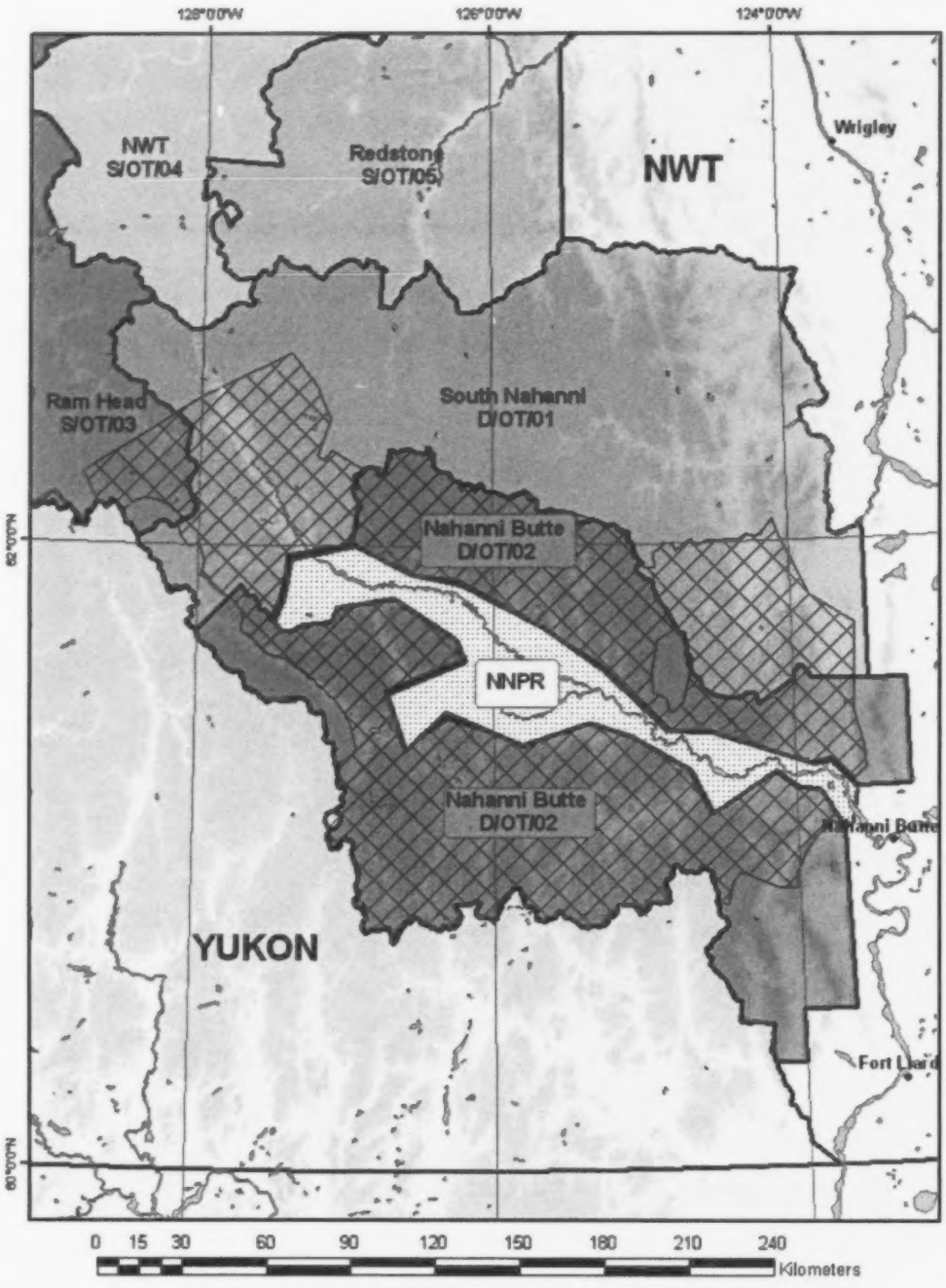


Figure 2. The original boundary of NNPR, in white, with the expanded boundary (9 June 2009) indicated by the checkered polygon.

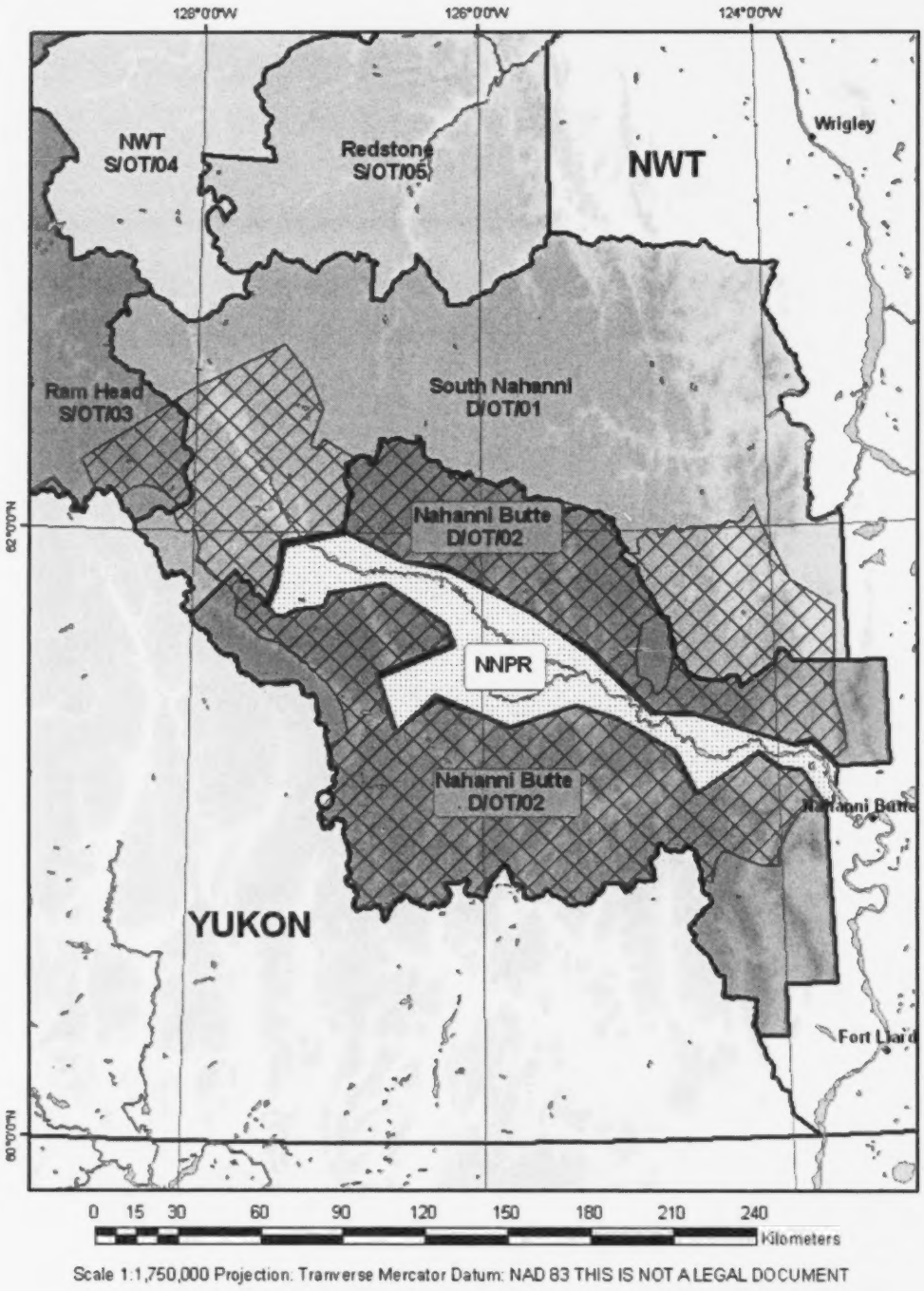
which enhances the outfitters' ability to practice sustainable harvest through annual allocation of the harvest effort.

The hunting licence year in the NT runs from 01 July to 30 June and those who desire to hunt big game within the NT must annually obtain a big game hunting licence and must be at least 16 years old (Environment and Natural Resources 2010). There are four classes of licenced big game hunters in the NT:

1) *General* - subsistence harvesters, primarily aboriginal people.
2) *Resident* - Canadian citizens or landed immigrants who have been living in the NT for at least two consecutive years prior to application for the licence.
3) *Non-resident* - Canadian citizens or landed immigrants who live outside the NT, or have not resided in the NT for a full two years prior to application for the licence.
4) *Non-resident Alien* - an individual who is neither a NT resident nor a non-resident.

Both non-resident and non-resident alien hunters must use the services of an outfitter and must be accompanied by a licenced guide at all times while hunting big game. For simplification in this report, we call both non-resident and non-resident alien hunting licence holders 'non-residents' and combine their harvest statistics. The data from eight resident hunters, who harvested Dall's sheep in the Mackenzie Mountains without a guide, have been included in the number of sheep harvested and the age and horn length measurements in this report as indicated.

Individual non-resident hunters are annually restricted to one each of the following big game species (Appendix B): Dall's sheep (male with at least ¾ curl horns), mountain woodland caribou (either sex), moose (either sex), mountain goat (either sex),



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wolf (either sex)[1], wolverine (either sex), and black bear (adult not accompanied by cub(s)). Although non-resident hunters are allowed to hunt female moose and caribou they prefer to hunt males for their trophy antlers, and the harvest is exclusively males. Non-resident hunting for grizzly bears was closed in 1982 as a result of concerns about over-harvest (Miller *et al.* 1982; Latour and MacLean 1994). There are currently no restrictions on the total number of each big game species that an outfitter can take within the zone for which they are licenced.

Wildlife management within the Mackenzie Mountains is the responsibility of a variety of government agencies and boards set up as a result of comprehensive land claim agreements. The Nahanni National Park Reserve (4,766 km^2 original pre- 2009 boundary) in the south Mackenzie Mountains is managed by Parks Canada – an agency of the Canadian federal government. Under the terms of the *Sahtu Dene and Metis Comprehensive Land Claim Agreement* (signed in 1993) and the *Gwich'in Comprehensive Land Claim Agreement* (signed in 1992), primary responsibility for wildlife management within the two settlement areas lies with the Sahtu Renewable Resources Board (SRRB) and the Gwich'in Renewable Resources Board (GRRB), respectively. Approximately 68,000 km^2 of the central and northern Mackenzie Mountains are within the Sahtu Settlement Area and 8,300 km^2 are within the Gwich'in Settlement Area, which encompass the extreme north end of the range (see Figure 1). However, the GNWT maintains ultimate jurisdiction for management of wildlife and wildlife habitat within each of the claim areas. Environment and Natural Resources (ENR) of the GNWT is responsible for licencing outfitters, guides, and hunters and for annually monitoring non-resident big game harvest in the Mackenzie Mountains. Under

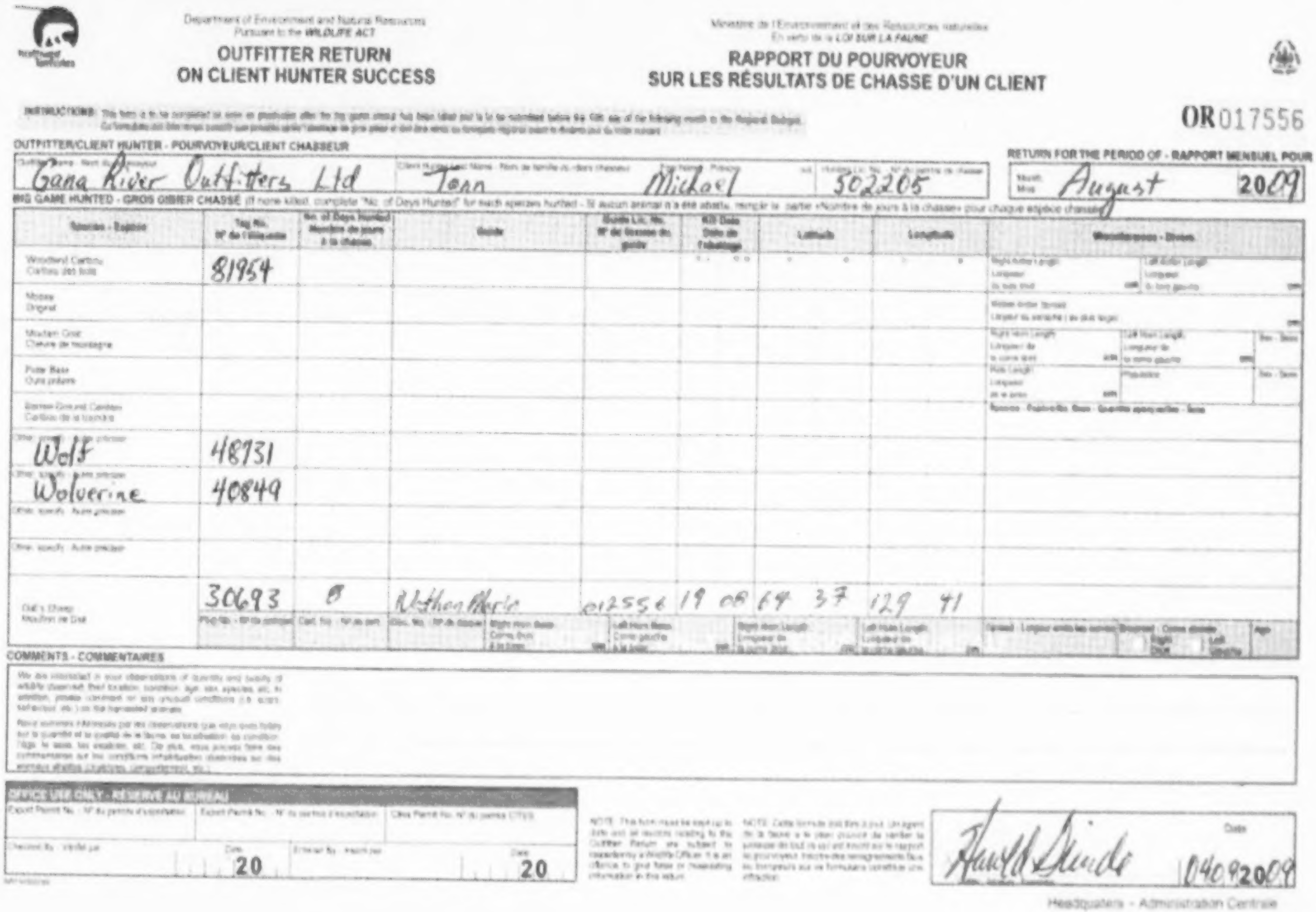
[1] In the Sahtu Region non-resident hunters and non-resident alien hunters are allowed to hunt two wolves from 1 August – 15 April.

the terms of the *Dehcho First Nations Interim Measures Agreement* (signed in 2001), and its recent extended agreement period, ENR has primary responsibility for wildlife management within the Dehcho region (approximately 59,000 km^2) of the southern half of the Mackenzie Mountains (see Figure 1).

Each year ENR, under provisions in the GNWT's *Wildlife Business Regulations*, requires outfitters to submit an outfitter return on a client hunter success form for each person that purchased a NT non-resident big game hunting licence (Figure 3). These are known as outfitter return forms and they must be submitted whether or not a client actually hunted, and whether or not any game was harvested. The outfitter return forms allow us to quantify harvest by non-resident hunters to help biologists with the GRRB, SRRB, and ENR to ensure that the harvest of each species is within sustainable limits.

In 1995, the then Department of Resources, Wildlife and Economic Development (RWED), requested that all non-resident hunters also fill out a voluntary questionnaire. The questionnaire has evolved through the years based upon suggestions from outfitters, their clients, and government staff. Different questions pertaining to wildlife observations, the quality of the hunting experience, the quality of services related to hunter travel, and specific topics for hunter comment have come and gone. However, one key component of the questionnaire that has remained constant pertains to reporting the different types and numbers of wildlife species seen during their hunts. These data have been recorded and the questionnaire forms have been and will be referred to as hunter observation forms in this report (Figure 4).

This is the sixteenth consecutive year that a summary of the data collected by ENR on non-resident hunters in the Mackenzie Mountains has been made. In the text of



Department of Environment and Natural Resources
Pursuant to the WILDLIFE ACT

OUTFITTER RETURN ON CLIENT HUNTER SUCCESS

Ministère de l'Environnement et des Ressources naturelles
En vertu de la LOI SUR LA FAUNE

RAPPORT DU POURVOYEUR SUR LES RÉSULTATS DE CHASSE D'UN CLIENT

OR017556

OUTFITTER/CLIENT HUNTER - POURVOYEUR/CLIENT CHASSEUR

Outfitter: Gana River Outfitters Ltd — Client Last Name: Tonn — First Name: Michael — Hunting Lic. No.: 502205

RETURN FOR THE PERIOD OF - RAPPORT MENSUEL POUR: Month / Mois: August 2009

BIG GAME HUNTED - GROS GIBIER CHASSÉ

Species - Espèce	Tag No. / N° de l'étiquette	No. of Days Hunted / Nombre de jours à la chasse	Guide	Guide Lic. No. / N° de licence du guide	Kill Date / Date de l'abattage	Latitude	Longitude
Woodland Caribou / Caribou des bois	81954						
Moose / Orignal							
Mountain Goat / Chèvre de montagne							
Polar Bear / Ours polaire							
Barren-Ground Caribou / Caribou de la toundra							
Other: Wolf	48731						
Other: Wolverine	40849						
Other, specify - Autre préciser							
Other, specify - Autre préciser							
Dall's Sheep / Mouflon de Dall	30693	8	Nathan Mertz	012556	19 08	64 37	129 41

COMMENTS - COMMENTAIRES

OFFICE USE ONLY - RÉSERVÉ AU BUREAU

Date: 04 09 2009

Headquarters - Administration Centre

Figure 3. Example of a completed outfitter return on client hunter success form.

Department of Environment and Natural Resources
Pursuant to the WILDLIFE ACT

OUTFITTER RETURN
ON CLIENT HUNTER SUCCESS

Ministère de l'Environnement et des Ressources naturelles
En vertu de la LOI SUR LA FAUNE

RAPPORT DU POURVOYEUR
SUR LES RÉSULTATS DE CHASSE D'UN CLIENT

OR017556

INSTRUCTIONS: This form is to be completed as soon as practicable after the big game animal has been killed and is to be submitted before the 10th day of the following month to the Regional Budget.

OUTFITTER/CLIENT HUNTER - POURVOYEUR/CLIENT CHASSEUR

Outfitter's Name: Gang River Outfitters Ltd
Client Surname: Tann
Client Given Name: Michael
Client No.: 502205

RETURN FOR THE PERIOD OF - RAPPORT MENSUEL POUR
Month: August
Year: 2009

BIG GAME HUNTED - GROS GIBIER CHASSÉ (If none killed, complete "No. of Days Hunted" for each species hunted - Si aucun animal n'a été abattu, remplir la partie «Nombre de jours à la chasse» pour chaque espèce chassée)

Species - Espèce	Tag No. - N° de l'étiquette	No. of Days Hunted - Nombre de jours à la chasse	Guide	Guide Lic. No. - N° de licence du guide	ED Date - Date de l'abattage	Latitude	Longitude	Miscellaneous - Divers
Woodland Caribou - Caribou des bois	81959							
Moose - Original								
Mountain Goat - Chèvre de montagne								
Polar Bear - Ours polaire								
Barren Ground Caribou - Caribou de la toundra								
Other - Autre: Wolf	48731							
Other - Autre: Wolverine	40849							
Other - Autre:								
Other - Autre:								
Deer - Chevreuil / Mountain Ox - Dall's Sheep - Mouton de Dall	30693	8	Matthew Morris	01255	19 08	69 37	129 41	

Tag No. - N° de l'étiquette | Cert. No. - N° du certificat | Class No. - N° de classe | Right Horn Base Circumference - Circonférence de la base de la corne droite | Left Horn Base Circumference - Circonférence de la base de la corne gauche | Right Horn Length - Longueur de la corne droite | Left Horn Length - Longueur de la corne gauche | Spread - Largeur entre les cornes | Broomed - Cornes ébréchées: Right - Droite, Left - Gauche | Age

COMMENTS - COMMENTAIRES

We are interested in your observations. If possible and useful (if wildlife observed, their location, condition, age, sex, species, etc. In addition, please comment on any unusual conditions (i.e. access, behaviour, etc.) on the harvested animals.

Nous sommes intéressés par vos observations. Si possible et utile (si vous avez noté sur la faune, sa localisation, sa condition, l'âge, le sexe, les espèces, etc.). De plus, nous prions nos commentaires sur les conditions inhabituelles observées sur les animaux abattus (accès, comportement, etc.).

OFFICE USE ONLY - RÉSERVÉ AU BUREAU

Export Permit No. - N° du permis d'exportation | Export Permit No. - N° du permis d'exportation | Data Permit No. - N° du permis CITES

Received By - Reçu par | Date: 20 | Entered By - Inscrit par | Date: 20

NOTE: This form must be kept on file at all times and all records relating to the Outfitter Return are subject to inspection by a Wildlife Officer. It is an offence to give false information in completing information in this return.

NOTE: Cette formule doit être à jour. Les agents de la faune ou un préposé peuvent en vérifier le contenu de tout ce qui est inscrit sur le rapport et procéder à toutes des renseignements faux ou trompeurs sur la formulaire constitue une infraction.

Harold Stinde — Date: 04092009

Headquarters - Administration Centrale

Figure 3. Example of a completed outfitter return on client hunter success form.

MACKENZIE MOUTAINS, NORTHWEST TERRITORIES
HUNTER WILDLIFE OBSERVATION REPORT – 2007

Dear Hunter: The Department of Environment and Natural Resources request your kind assistance with completing this questionnaire about your NWT hunting experience, in order to assist us with the management of Mackenzie Mountain big game populations. All the requested information is completely voluntary, but your providing it to us is most appreciated.

HUNTER INFORMATION

Last Name	First Name and Initials	
CLIFFORD	GREGORY P	
Address - number and street, box number	Town, City	Province, State, Country
14 SAGE ROAD	LANDSR.	[illegible] USA

Hunting License # NL 715052 Outfitter Zone: GL01101 Outfitter: [illegible] RIVER

Start Date of Hunt 7/15 2007 End Date of Hunt 7/24 2007 Observations Made Over 10 Days

ESTIMATED NUMBER OF DALL'S SHEEP SEEN			
¾ and Full Curl Rams	Less than ¾ Curl Rams	Ewes	Lambs
25	46	74	17

ESTIMATED NUMBER OF WOODLAND CARIBOU SEEN		
Bulls	Cows	Calves
2	1	1

ESTIMATED NUMBER OF MOOSE SEEN		
Bulls	Cows	Calves
0	0	0

ESTIMATED NUMBER OF MOUNTAIN GOAT SEEN			
Billys	Nannys	Kids	Unknown Age
0	0	0	0

Other Species						
	Wolf	Wolverine	Black Bear		Grizzly Bear	
			Adult	Cub	Adult	Cub
Number(s) Seen	3	0	0	0	1	0

How would you rate your overall hunting experience in the Mackenzie Mountains?
Excellent X Very Good ____ Good ____ Fair ____ Poor ____

How many times have you hunted in the Mackenzie Mountains, **including** this year's hunt? 2

Do you plan to return to hunt in the Mackenzie Mountains again? Yes X No ____

COMMENTS: EXCELLENT AREA, LOVE IT HERE

Thank You! Please give this form to the Officer or Clerk when you are exporting your trophies, or to the guide outfitter with whom you hunted. We would appreciate receiving this form whether of not you harvested an animal(s).

Figure 4. Example of a fully completed hunter observation report form.

this document, data for 1995 are found in Veitch and Popko (1996), for 1996 in Veitch and Popko (1997), for 1997 in Veitch and Simmons (1998), for 1998 in Veitch *et al.* 2000b, for 1999 and 2000 in Veitch and Simmons (2000; 2002; respectively), for 2001 by Veitch and Simmons (unpublished data), for 2002-2009 in Larter and Allaire (2003; 2004; 2005a; 2006; 2007; 2008; 2009; 2010 respectively). Additionally, Latour and MacLean (1994) summarized data for 1979 to 1990. This report compiles the harvest data collected during the 2010 hunting season and compares it with available data collected since 1995, and earlier when available.

Nahanni National Park Reserve Expansion

Nahanni National Park Reserve (NNPR), encompassing an area of 4,766 km^2 in the southern Mackenzie Mountains, was originalliy established in 1972, after Prime Minister Pierre Elloit Trudeau canoed down the Nahanni River. The Park was in "reserve" status pending settlement of outstanding aboriginal land claims in the region, which remain ongoing. On 9 June, 2009, the Canadian government, with Dehcho First Nations, announced legislation increasing the area of NNPR to *ca* 30,000 km^2 (11,583 mi^2). This newly enlarged boundary includes 91% of the greater Nahanni ecosystem and most of the South Nahanni River watershed in the Dehcho region (www.pc.gc.ca). The enlarged boundary also overlaps three of the eight outfitting zones which were established in the Mackenzie Mountains in 1965: Ram Head Outfitters (S/OT/03), South Nahanni Outfitters (D/OT/01) and Nahanni Butte Outfitters (D/OT/02). Of the total area of their outfitting zones, 4.7% of the Ramhead zone, 27.2% of the South Nahanni zone and 79.4% of the Nahanni Butte zone fall within the newly expanded boundary of the NNPR (Table 1).

Table 1. The area (km²) and percent of the outfitting zone that lie within the 2009 expanded boundary of Nahanni National Park Reserve.

Outfitter	Area of outfitting zone	Area of outfitting zone within new NNPR	Percent of zone within new NNPR
Ram Head Outfitters	19,734.82 km²	921.27 km²	4.7 %
South Nahanni Outfitters	25,024.16 km²	6,811.10 km²	27.2 %
Nahanni Butte Outfitters	21,962.30 km²	17,450.66 km²	79.4 %

Parks Canada is currently negotiating with the operators of these outfitting zones in regards to third party interests in the land and land transfer. A tentative ten year time line from the date of the announced expanded boundary has been proposed. Until negotiations have been completed, and the GNWT has been advised of such, it remains business as usual for these outfitters; ENR will continue to issue licences, tags, and export permits for harvesting by these three outfitters in their zones.

The Prairie Creek mine, established in 1966, now falls completely within the newly expanded boundary of NNPR. However, the mine and an area of *ca.* 300 km^2 surrounding the site were specifically excluded from NNPR so that the mine owned by Canadian Zinc was assured of its third party rights to operate and access the mine site. A new bill amending the National Parks Act solely for NNPR was required to assure these third party rights (www.canadianzinc.com).

Share Sale Agreement of Outfitting Zone

Arctic Red River Outfitters (ARRO, G/OT/01) completed a share sale agreement during 2009. ARRO obtained a surrender of rights of first refusal from the Gwich'in

Tribal Council as part of the sale requirements. ARRO operates in two settled land claim areas; 78% falls within the Gwich'in land claim area and 22% within the Sahtu land claim area (Figure 1). Rights of first refusal, however, cannot be provided to two different land claim organizations. Five of the eight Mackenzie Mountain Outfitting zones cover more than one land claim area (Table 2). ENR plans on reviewing the big game licensing procedures in regard to this situation for future share sale agreements of outfitting zones.

Table 2. The areas (km^2) and percent of each outfitting zone that fall within different land claim areas. Bold indicates zones found exclusively within one land claim area.

Outfitter Zone	Total Area (km^2)	Dehcho Claim (km^2)	%	Sahtu Claim (km^2)	%	Gwitch'in Claim (km^2)	%
G/OT/01	14,753.70	n/a	0.0	3,207.90	22.0	11,545.80	78.0
S/OT/01	9,272.87	n/a	0.0	9,029.01	97.4	243.86	2.6
S/OT/03	19,734.82	1,247.15	6.3	18,487.67	93.7	n/a	0.0
S/OT/05	14,014.24	1,810.61	12.9	12,203.63	87.1	n/a	0.0
S/OT/02	12,721.28	n/a	0.0	12,721.28	100.0	n/a	0.0
D/OT/01	25,024.16	22,385.62	89.5	2,638.54	10.5	n/a	0.0
S/OT/04	8,125.57	n/a	0.0	8,125.57	100.0	n/a	0.0
D/OT/02	21,962.30	21,962.30	100.0	n/a	0.0	n/a	0.0

METHODS

Prior to the start of the 2010 hunting season, each outfitter in the Mackenzie Mountains received sufficient copies of the outfitter return and hunter observation forms for all their clients for the year. The *Wildlife Business Regulations* require outfitter returns be returned by the tenth day of the month following the month of the hunt – e.g., for a hunter that was in the field in July, a form must be submitted by the 10th of August. Those forms were submitted to the senior biologist in the Dehcho or Sahtu, whether or not a client actually hunted and whether or not harvest occurred. In co-operation with ENR Renewable Resource Officers and the outfitters, persistent attempts were made to obtain outfitter return forms for every non-resident that held a big game hunting licence through a Mackenzie Mountain outfitter in 2010.

Data from both the outfitter return forms and hunter observation forms were entered into *Excel 2007* (Microsoft Corporation, Seattle, WA) spreadsheets. Data were cross-checked with the records of sequentially numbered, unique identifier plugs inserted in the horns of legally harvested rams found in the Licence Information System-IntraNet (LIS-IN) data management system maintained by ENR offices across the NT, and also with GNWT wildlife *Export Permit* forms to ensure that all data were verified and that the spreadsheets contained all appropriate available data required for analyses.

We distributed new hunter observation forms in 2010 for consistency and we recorded all observations directly from these hunter observation forms. If we did not receive a hunter observation form, but wildlife observation data were recorded on the outfitter return form, we used these wildlife observation data. If observation information differed between the hunter observation form and the outfitter return form for the same client we used the data from the hunter observation form. Occasionally we received

identical observation data from forms of different hunters. These hunters had the same guides and lengths of hunts and obviously had hunted together. We recorded forms with data that had been provided, but for the wildlife observation analyses only one set of these observations was used.

All descriptive statistical analyses were performed using *Excel 2007* (Microsoft Corporation, Seattle, WA). We present means ± standard deviation. Some statistical analyses were performed using Minitab 7.2 software (Minitab Inc. 1989).

RESULTS AND DISCUSSION

Hunters

Big game hunting licences for the Mackenzie Mountains were bought by 375 non-resident hunters in 2010 (Table 3). This is up from the 361 average number sold between 1991-2010 (range 321-407) (Figure 5; Appendix F). Of those, 337 came to the NT and spent some time hunting; 38 either cancelled their hunts, decided not to hunt for themselves but participated with other hunters they knew, or decided not to hunt due to unforeseen complications after arriving in the NT. A majority of these were guides, who purchase licences every year but rarely have the opportunity to hunt themselves. In 2010, licence sales to non-resident Canadians (n=95) represented 25% of the number of licences sold, slightly more than the 23% reported in 2009, but similar to the 25% in 2008. We presume that the continued strength of the Canadian dollar is a major contributing factor to the higher number of Canadian sport hunters over the past few years. Guided hunts are marketed in American dollars. The number of foreign non-resident hunters in 2010 was higher than in 2009 (280 vs. 253). For an eigth straight year the number of hunters from countries other than the United States increased, mostly Europeans and South Americans (Table 3). The change in ownership of South Nahanni Outfitters (D/OT/01) has directly resulted in an increased number of European and South American clients. A weaker American dollar against foreign currencies makes hunts more attractive to foreign clients, and outfitters realize the need to diversify their clientelle base (Jim Lancaster, personal communication).

For only the second time, a resident hunter successfully harvested a grizzly bear with a guide in 2010. The bear was harvested in zone S/OT/03. In 2009 a resident hunter successfully harvested a grizzly bear in zone S/OT/01. Normally guided harvest

in the Mackenzie Mountains occurs from July to October, however successful winter hunting of wolves occurred for the second consecutive hunting season in zone S/OT/01. Two non-resident hunters with guides harvested two wolves each in April 2011.

We received all but nine mandatory outfitter return forms for the 375 people that purchased non-resident licences. Voluntary hunter observation report forms were received from 203 (60%) of the 337 that did at least some hunting in 2010 (Table 4). After consensus by outfitters at the 2003 annual general meeting of the Association of Mackenzie Mountain Outfitters (AMMO) to increase the number of voluntary hunter observation forms returned, the 2010 level of return is disappointing being similar to pre-2004 return levels. Although most outfitters endeavour to have clients complete and submit these forms, there are two zones, with fairly large clientele, that provided a limited number of returns. We received only 19%, seven of 36 forms, from zone S/OT/03 and 34%, 19 of 56 forms, from zone S/OT/02 in 2010. To be able to generalize observations over the entire Mackenzie Mountains, representative observations are required from all outfitting zones; these two outfitter zones encompass the greatest range in latitude in the Mackenzie Mountains (Figure 1). See figure 4 as an example of a fully completed hunter observation form.

Table 3. Province, state and/or country of origin of the 375 non-residents who purchased licences for hunting in the Mackenzie Mountains, 2010.

Canada		United States		Europe		Other	
Yukon	5	Eastern States[1]	93	Spain	2	Mexico	9
British Columbia	42			Germany	23	Chile	1
Alberta	43	Western States[2]	132	Austria	3	Argentina	2
Saskatchewan	1			Sweden	1	Australia	2
Manitoba	0			Italy	5	South Africa	1
Ontario/ Quebec	4			Belgium	1		
Atlantic Provinces	0			Luxemburg	1		
				Russia	2		
				Czech Republic	2		
Total	95		225		40		15

[1] AL, AR, CT, DE, FL, GA, IL, IN, IA, KY, LA, ME, MD, MA, MI, MN, MS, MO, NH, NJ, NY, NC, OH, PA, RI, SC, TN, VT, VA, WV, WI
[2] AK, AZ, CA, CO, HI, ID, KS, MT, NE, NV, NM, ND, OK, OR, SD, TX, UT, WA, WY

Table 4. Percent of Mackenzie Mountain outfitter and non-resident hunter forms submitted, 1995-2010.

Form Type	2010	2009	2008	2007	2006	2005	2004	2003
Outfitter Return (mandatory)	98	99	99	98	99	100	99	98
Hunter Observation (voluntary)	60	62	71	65	64	65	74	60

Form Type	2002	2001	2000	1999	1998	1997	1996	1995
Outfitter Return (mandatory)	95	92	96	96	97	98	100	98
Hunter Observation (voluntary)	59	57	53	51	60	50	71	80

It is obvious that non-resident hunters immensely enjoy their hunting experience in the Mackenzie Mountains (Table 5). In 2010, 98% of respondents rated their experience as either excellent (88%) or very good (10%). Not only do voluntary client comments make specific mention of the high quality of hunts (n=87), and the abundance/quality of animals (n=42; Appendices C and D), but many comments make reference to 1) the professional and world class experience with their chosen guides, 2) the abundance of a wide variety of game species and predators, 3) the apparent health and condition of the game animals, 4) the pristine and scenic environment of the Mackenzie Mountains, and 5) compliments on the management and stewardship of the land.

Comments about grizzly bears have been common since the start of the voluntary hunter observation forms in 1995; their abundance, problems created around camps and kills, and the lack of, and need for, a grizzly hunting season being consistent themes. This year was no different (Appendices C and D). In 2000 we started getting comments about high wolf numbers. This has continued through this year, however all comments about wolves are from hunters in zone G/OT/01. Similar to last year we had comments about the expansion of the NNPR, which was announced 9 June 2009. Many questioned the need for such a large expansion, especially in an area that had been so respectfully managed on a sustainable basis. There were also comments about making a provision for hunting in the expanded area; GHL holders can hunt in the area.

Table 5. Satisfaction ratings for non-resident hunters (including non-hunting guides) in the Mackenzie Mountains, 1996-2010.

Rating	2010	2009	2008	2007	2006	2005	2004
Number of Hunters Reporting	193	191	239	239	230	256	229
Excellent (%)	88	86	85	81	80	90	84
Very Good (%)	10	12	10	12	16	7	10
Good (%)	1	2	4	5	3	2	5
Fair (%)	1	0	1	2	1	1	0
Poor (%)	0	0	0	0	0	0	1

Rating	2003	2002	2001	2000	1999	1998	1997	1996
Number of Hunters Reporting	191	193	191	158	157	202	144	224
Excellent (%)	82	82	75	76	73	80	78	77
Very Good (%)	15	15	16	17	20	17	17	17
Good (%)	3	3	6	6	5	2	3	2
Fair (%)	0	0	1	0	1	1	1	3
Poor (%)	0	0	1	1	2	0	1	1

A number of comments were raised this year about the timing of increases for trophy and tag fees, especially from the clients of outfitters who book hunts as an all-inclusive package. These hunts are booked a year in advance. Client concerns focused more on the timing of notification of the fee increase and not so much on the fee increases, which doubled. The announcement of trophy and tag fee increases for the 2010 hunting season was not made until May, about six weeks before they came into effect (Appendix B). Clients who purchased pre-sold package hunts had to either pay the increase once they arrived for their hunt, or the outfitters had to absorb the increased fees themselves. Clients and outfitters recommended notification of future fee

increases be provided early enough to avoid similar situations in future. Outfitters may also need to reconsider including trophy and tag fees in their packaging of hunts. Comments about inclement weather were few in 2010.

It was the first time hunting in the Mackenzie Mountains for 150 of 192 (78%) respondents (including non-hunting guides). The 42 repeat hunters had hunted from one to 15 times previously. Of 193 respondents (including non-hunting guides) 90% indicated they would like to return to the Mackenzies to hunt in the future.

Prior to the 2009 hunting season ENR worked with Association of Mackenzie Mountain Outfitters (AMMO) to devise a better reporting system for wild game meat use and distribution. What resulted was a supplemental summary meat record form that ENR would provide to each outfitter. This form could be used by itself or in addition to the AMMO meat forms which were voluntarily submitted to ENR. Unfortunately, in the past, AMMO meat forms from outfitters in the Sahtu did not always get turned in and/or forwarded to the Dehcho ENR office. Often because some outfitters keep the meat forms for their own records in order to have them available for inspection (Kelly Hougen, personal communication). Both forms record the amount of meat (Dall's sheep, northern mountain caribou, moose, and mountain goat) taken from harvested animals and how the meat was used/distributed. This year, in addition to the 82 AMMO meat forms voluntarily submitted by some of the outfitters, we received summary forms from six of the eight outfitters, G/OT/01, S/OT/01, S/OT/04, S/OT/05, D/OT/01 and D/OT/02, an increase over previous years. ENR plans on providing supplemental meat forms to all outfitters in future.

The provision of wild game meat by outfitters is an important and greatly appreciated local benefit but can often be a topic of heated local debate. With summary

forms supplementing individual meat forms we believe we have a better picture of the amount of wild game meat being distributed by the outfitters. Meat is used in camps by the outfitters and clients, is taken out with clients, and is distributed/provided to local communities. Generally the majority of meat from harvested Dall's sheep and mountain goats is used in the outfitter camps. Nonetheless, at least 1,249 kg (2,748 pounds) from 100 harvested Dall's sheep and 227 kg (500 pounds) from 12 harvested mountain goats, was distributed locally. Northern mountain caribou and moose meat is also used in the camps, but harvested mountain caribou and moose make up a large portion of the wild game meat that is distributed locally: at least 4,819 kg (10,602 pounds) from 101 northern mountain caribou and at least 9,007 kg (19,815 pounds) from 46 moose. The replacement cost of this amount of meat from local northern retailers is estimated conservatively at about $306,040, using $20/kg.

Dall's Sheep (*Ovis dalli dalli*)

Dall's sheep is one of the most desired species sought by non-resident hunters in the Mackenzie Mountains. Tags to hunt Dall's sheep were purchased by 253 (66%) non-resident hunters in 2010. This is similar to the average number of tags purchased in the past 16 years (Table 6). At least 76% of sheep tag holders (including eight resident hunters) pursued Dall's sheep and harvested 193 rams, slightly less than the average 198 sheep harvested in the Mackenzie Mountains (1991-2009) (Figure 5; Appendix F). The mean (± SD) length of a sheep hunt was 4.0 ± 3.0 days, similar to hunt lengths from 1997 to 2009 (Table 7), but less than the 5.3 day average from 1979-1990 (Latour and MacLean 1994). Outfitted hunts in the Mackenzie Mountains are generally booked for ten days; when hunters fill their sheep tag, any remaining time on the hunt is

typically spent in pursuit of other big game species for which tags are held, or in hunting small game.

Harvest by non-residents comprises at least 90% of the total annual harvest of Dall's sheep in the Mackenzie Mountains and takes only 0.8 to 1.5% of the estimated 14,000 to 26,000 Dall's sheep in the Mackenzie Mountains (Veitch *et al.* 2000a). Therefore, the current non-resident harvest level appears well within sustainable limits, provided that hunting pressure is geographically distributed across each of the zones. In the Yukon Territory - where harvest is managed by a full curl rule - thinhorn sheep managers have set the sustainable harvest at 4% of the non-lamb population (Yukon Renewable Resources 1996). In those areas of the Yukon where the management objective is to increase population size, harvest is limited to 2% of the total population.

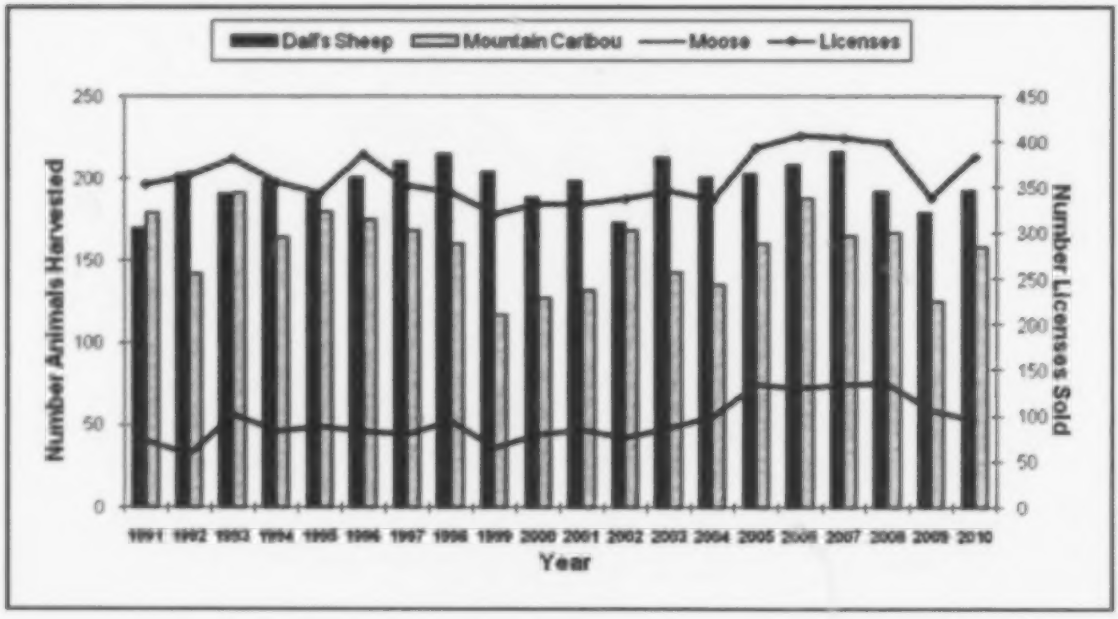


Figure 5. The number of Dall's sheep, mountain caribou, and moose harvested in the Mackenzie Mountains by non-resident hunters, and the number of non-resident licences sold during 1991-2010.

There has been remarkable consistency in the mean outside contour length of the right horns from rams harvested by non-residents from 1972-2010, mean 89.0 ± 1.7cm (SD) (Appendix E; Table 8), which is surprising given the increase in average age of harvested sheep during that same period. We expected to see more broomed or broken horn tips on older animals, since horn breakage generally occurs as a result of fights between rival males (Geist 1993).

In 2010, of 193 harvested rams, 132 (68%) were ≥10-years-old. The mean age (± SD) of harvested rams was 10.8 ± 1.7 years (range 7.5 to 14.5 years; Table 9). This is the second highest average age of harvested rams recorded in the Mackenzie Mountains since records have been kept (1967) and the 23rd consecutive year where the reported mean age of harvested rams has been 9.5 years or older (Appendix E). Brooming of 31% of left and 30% of right horns from plugged trophies was similar to the 31% (left) and 32% (right) brooming average over the past 14 years. The continued high age and consistent brooming reported on harvested trophy sheep may be a result of harvest being spread out in time and space within hunting zones. Exclusivity of non-resident big game harvesting within the each zone provides this opportunity. Outfitters have indicated that they harvest in different parts of their zone on a rotational basis and forgo hunting in some areas for two or three seasons.

Table 6. Tags for big game species purchased by non-resident hunters with outfitters in the Mackenzie Mountains, 1995-2010.

Species	2010 384 hunters		2009 339 hunters		2008 391 hunters		2007 399 hunters		2006 407 hunters		2005 394 hunters		2004 337 hunters		2003 347 hunters	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Dall's Sheep	253	66	215	63	261	67	266	67	276	68	246	62	229	68	257	74
Mountain Caribou	295	77	252	74	275	70	272	68	274	67	285	72	243	72	247	71
Moose	116	30	96	28	109	28	108	27	112	28	101	26	84	25	85	24
Mountain Goat	45	12	45	13	45	12	50	13	21	5	40	10	24	7	18	5
Wolf	294	77	252	74	228	58	227	57	201	49	214	51	166	49	207	60
Wolverine	171	45	133	39	111	28	150	38	108	27	154	39	89	26	141	40
Black Bear	28	7	22	6	2	1	7	2	3	1	40	10	8	2	9	3

Species	2002 329 hunters		2001 339 hunters		2000 332 hunters		1999 321 hunters		1998 345 hunters		1997 352 hunters		1996 387 hunters		1995 343 hunters	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Dall's Sheep	218	66	220	65	231	70	227	71	246	71	252	72	252	65	218	64
Mountain Caribou	229	69	201	59	206	62	181	56	223	65	260	74	274	71	233	68
Moose	68	21	65	19	69	21	63	20	69	20	73	21	74	18	70	20
Mountain Goat	18	5	12	4	12	4	6	2	23	7	30	8	14	4	16	5
Wolf	159	48	137	40	155	47	89	28	165	48	209	59	193	50	72	21
Wolverine	97	29	83	25	85	26	65	20	99	29	135	38	114	30	35	10
Black Bear	3	1	0	0	6	2	2	<1	2	<1	8	2	0	0	0	0

Table 7. Mean length, standard deviation, and range (in days) of Dall's sheep hunts where at least one day was spent hunting from 1997-2010.

	2010	2009	2008	2007	2006	2005	2004
Number of reports	179	179	192	216	214	190	167
Mean hunt length	4.0	3.9	3.7	4.1	4.1	4.1	4.0
Standard deviation	3.0	2.6	2.6	2.6	2.7	2.6	2.9
Range	1-13	1-10	1-14	1-13	1-12	1-14	1-17
	2003	**2002**	**2001**	**2000**	**1999**	**1998**	**1997**
Number of reports	189	174	176	198	201	224	216
Mean hunt length	3.8	4.7	4.8	4.6	4.7	4.4	4.3
Standard deviation	2.9	2.7	3.0	2.7	3.1	2.8	2.6
Range	1-12	1-12	1-15	1-15	1-16	1-15	1-12

Table 8. Measurements of Dall's sheep ram horns from sheep harvested by non-resident hunters in the Mackenzie Mountains, 2010.

	Left Horn Contour Length		Right Horn Contour Length		Left Horn Base Circumference		Right Horn Base Circumference		Tip to Tip Spread	
	cm	in	cm	in	Cm	in	cm	in	cm	in
Mean	89.2	35.1	88.7	34.9	33.1	13.0	33.1	13.0	58.8	23.1
Std Dev	7.3	2.9	8.0	3.1	1.8	0.7	1.8	0.7	9.8	3.9
Maximum	105.5	41.5	103.5	40.7	38.0	15.0	38.0	15.0	87.0	34.2
Minimum	74.0	29.1	56.0	22.0	28.5	11.2	28.5	11.2	42.0	16.5

From hunters' classifications of sheep observed during their hunts in 2010 we calculated an estimated 48.7 lambs per 100 ewes (Table 10). This is lower than the 55:100 lamb:ewe average ratio reported since 1995 (Appendix G). For the Richardson Mountains of the northern Yukon and NT, Nagy and Carey (1991) suggest an August ratio of 43 lambs per 100 ewes would have allowed for their observed 10.5% average annual rate of increase from 1986 to 1991. Subsequent to a decline in this unhunted population from 1997-2003, Nagy *et al.* (in prep.) reported 28 lambs per 100 'nursery sheep' in August 2003. Jorgenson (1992) summarized 17 years of lamb:ewe classification data for a population of bighorn sheep in west-central Alberta and found a mean of 43 lambs per 100 ewes in September (range 25 to 54).

Differences in adult sex ratios among populations may result from differences in hunting pressure, differences in survival of males and females from birth to adulthood, or both (Nichols and Bunnell 1999). However, since the ratio of rams to ewes is almost never equal in wild populations of mountain sheep, even where they are unhunted, it is clear that there is a different natural mortality rate for the two sexes. Geist (1971) suggested that this difference is a result of injuries and stress accumulated by males during the breeding season.

Table 9. Age-structure of Dall's sheep rams harvested by non-resident and resident (n=8) hunters in the Mackenzie Mountains, 1995-2010, based upon counting horn annuli.

	2010		2009		2008		2007		2006		2005		2004		2003		2002		2001		2000		1999		1998		1997		1996		1995	
Age	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
3.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0
4.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5.5	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0	1	0.5	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	1	0.5	1	0.5
6.5	0	0.0	0	0.0	1	0.5	2	0.9	1	0.5	1	0.5	3	1.5	8	3.8	2	1.2	4	2.2	3	1.6	1	0.5	4	2.0	1	0.5	5	2.5	4	2.1
7.5	3	1.6	6	3.4	4	2.1	7	3.2	8	3.8	11	5.6	14	7.0	12	5.7	6	3.6	15	8.2	16	8.5	13	7.1	9	4.3	12	5.8	21	10.5	16	8.5
8.5	20	10.4	19	10.7	21	11.0	17	7.9	26	13.9	24	12.2	41	20.0	43	20.5	44	26.5	33	18.0	39	20.8	23	12.6	39	18.8	39	18.8	47	23.5	49	25.9
9.5	36	18.7	26	14.6	48	25.0	33	15.3	49	25.5	54	27.6	49	24.5	72	34.3	43	25.9	41	22.4	40	21.2	49	26.8	45	21.7	52	25.1	56	28.0	51	27.0
10.5	53	27.5	46	25.8	53	27.6	54	25.0	54	26.4	47	24.0	43	21.5	45	21.4	39	23.5	45	24.6	41	21.8	47	25.7	63	30.4	58	28.0	36	18.0	34	18.0
11.5	41	21.2	39	21.9	28	14.6	65	30.1	36	17.8	39	19.9	27	13.2	11	5.2	16	9.6	29	15.9	28	14.9	29	15.8	30	14.5	24	11.6	26	13.0	14	7.4
12.5	23	11.9	23	12.9	25	13.0	19	8.9	23	12.0	13	6.6	16	7.8	12	5.7	9	5.4	11	6.0	14	7.5	15	8.2	12	5.8	15	7.2	6	3.0	14	7.4
13.5	13	6.7	11	6.1	7	3.6	15	6.9	6	2.9	5	2.6	3	1.5	2	1.0	6	3.6	10	5.5	3	1.6	6	3.3	2	1.0	4	1.9	1	0.5	5	2.6
14.5	2	1.0	6	3.4	4	2.1	2	0.9	1	0.5	1	0.5	3	1.5	3	1.4	1	0.6	0	0.0	3	1.6	0	0.0	1	0.5	2	1.0	0	0.0	1	0.5
15.5	0	0.0	1	0.6	1	0.5	1	0.5	2	1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	1	0.5	0	0.0	0	0.0	0	0.0
16.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
17.5	0	0.0	1	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
>10y	132		127		118		156		122		105		92		74		71		95		90		97		109		102		69		68	
%>10	68.4		71.3		61.5		72.2		59.2		53.6		46.0		35.2		42.7		51.0		47.9		53.0		52.6		49.5		34.5		36.0	
>12y	38		42		37		37		32		19		22		18		16		21		21		21		16		21		7		20	
%>12	19.7		23.6		19.3		17.1		15.5		9.7		11.0		8.6		9.6		11.2		11.2		11.4		7.7		10.1		3.5		10.6	

Table 10. Observations of Dall's sheep reported by non-resident hunters in the Mackenzie Mountains, 2010.

	Number of Hunters Reporting	Number Observed	Mean Number Observed/hunter	Percent of Sheep Classified
Rams	169	3,404	20.1	38.6
Ewes[1]	154	3,651	23.7	41.3
Lambs	146	1,777	12.2	20.1

[1] includes females >1-yr-old, yearlings, and younger rams. Also called 'nursery sheep'.

The 93:100 ram to ewe ratio (ram:ewe) estimated from hunters' observations in 2010 is generally similar to that reported since 2004 (Appendix G). Since 2004, hunters have generally observed more rams with <¾ curl than rams with >¾ curl. Strong cohorts of juvenile rams may be a factor in the recent higher ram:ewe ratios reported.

In the Yukon, mid to late June annual aerial surveys to count and classify sheep from 1973 to 1998 reported a mean of 48 rams (range 28 to 74) per 100 'nursery sheep' (Jean Carey, Yukon Dept. of Renewable Resources, unpublished data). For the unhunted Richardson Mountains herd (Yukon-Northwest Territories), Nagy *et al.* (in prep.) reported 41 rams per 100 'nursery sheep' in 2003 following a decline from peak population size in 1997. In Alaska, ram:ewe for two unhunted herds in Denali and Gates of the Arctic National Parks typically averaged 60-67:100 (Nichols and Bunnell, 1999). In more heavily hunted Alaskan herds, ram:ewe ranged from 33:100 (heavily hunted) to 87:100 (lightly hunted). The ram:ewe ratios reported for the Mackenzie Mountains since1995 (Appendix G) suggest that the harvest of rams in the Mackenzie Mountains is sustainable at current levels.

Table 11. Classification of Dall's sheep rams observed by non-resident hunters in the Mackenzie Mountains, 1995 - 2010.

Ram Class	2010		2009		2008		2007		2006		2005		2004		2003	
	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl
Number of hunters reporting	158	142	139	132	184	174	150	168	180	171	186	182	188	183	127	121
Number of rams classified	1,314	1,620	1,040	1,093	1,520	1,698	1,902	2,266	1,769	2,019	1,787	1,899	2,185	2,324	1,662	1,654
Percent of rams classified	44.8	55.2	48.8	51.2	47.2	52.8	45.6	54.4	46.7	53.3	48.5	51.5	48.5	51.5	50.1	49.9
Mean number of rams observed/hunt	8.3	11.4	7.5	8.3	8.3	9.8	11.0	13.5	9.9	12.0	9.6	10.4	11.6	12.7	11.9	11.9

Ram Class	2002		2001		2000		1999		1998		1997		1996		1995	
	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl
Number of hunters reporting	148	133	186	174	151	147	144	138	177	177	205	205	172	174	181	180
Number of rams classified	1,720	1,720	1,812	1,765	1,351	1,717	1,579	1,756	1,848	1,924	1,538	1,586	1,713	1,699	2,070	1,645
Percent of rams classified	50.0	50.0	50.7	49.3	44.0	56.0	47.3	52.7	49.0	51.0	49.2	50.8	50.2	49.8	55.7	44.3
Mean number of rams observed/hunt	11.6	12.9	9.7	10.1	8.9	11.7	11.0	12.7	10.4	11.3	7.5	7.7	10.0	9.8	11.4	9.1

The number of rams classified by curl in 2010 increased noticeably from the number classified in 2009, being more similar to pre-2009 levels (Table 11). The low number in 2009 was attributed to a low number of sheep hunters relative to other years. The number of sheep hunters in 2010 was similar to the average number over the past 16 years (Table 6). Hunters observed slightly fewer legal (>¾ curl) rams (n=1,314) than rams with <¾ curl (n=1,620) during their hunts. The mean number of legal rams observed per hunt was 8.3 (Table 11).

Northern Mountain Caribou (*Rangifer tarandus caribou*)

In their 2002 assessment, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the boreal population of woodland caribou as *Threatened* and the Northern Mountain population of woodland caribou as *Special Concern*. These two populations of woodland caribou were subsequently listed under the federal *Species at Risk Act* in 2004 and 2007 respectively. Caribou of the Mackenzie Mountains are part of the Northern Mountain population of woodland caribou. In order to be more specific and to avoid confusion this report will use "northern mountain caribou" when referring to caribou from the Mackenzie Mountains.

Northern mountain caribou are another of the more desired species sought by non-resident hunters. Tags were purchased by 295 (77%) of non-resident hunters (Table 6) and at least 54% of tag holders hunted caribou harvesting 158 males, similar to the 157 mean annual harvest from 1991-2010 (Figure 5; Appendix F). The mean (±SD) length of a caribou hunt, determined from the 175 reports where hunters spent at

least one day hunting, was 4.0 ± 3.0 days (range one to 16 days), comparable to that of previous years (Table 12).

From hunters' classifications of northern mountain caribou observed during their hunts, we calculated ratios of 44.6 calves and 46.4 bulls (males) per 100 adult females (cows); bulls comprised 24.3% of all caribou classified (Table 13). Both calf:cow and bull:cow are slightly higher than the averages since 1995 of 44:100 (range 36-59:100) and 37:100 (range 21-61:100), respectively (Appendix G).

Table 12. Mean length, standard deviation, and range (in days) of northern mountain caribou hunts where at least one day was spent hunting from 2000-2010.

	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Number reports	175	155	190	172	171	191	120	172	181	178	141
Mean hunt length	4.0	4.0	3.0	4.0	4.3	3.7	4.9	3.8	3.6	4.3	4.0
Std Dev	3.0	3.0	3.0	3.2	3.1	3.8	3.9	2.8	2.7	3.2	2.7
Range	1-14	1-14	1-15	1-16	1-14	1-32	1-34	1-14	1-12	1-15	1-12

Table 13. Observations of northern mountain caribou reported by non-resident hunters in the Mackenzie Mountains, 2010.

Sex/Age Class	Number of Hunters Reporting	Number Observed	Mean Number Observed/hunter	Percent of Total Classified
Bulls	169	5,631	33.3	24.3
Cows	157	12,142	77.3	52.4
Calves	134	5,411	40.4	23.3

In 2010 we received antler lengths from 107 (68%) of successful hunters; a lower percentage than in previous years. Antler measurement information sometimes goes

unreported on outfitter forms. This year, as in other years, there was substantial variation in antler lengths, range 90.0-137.2 cm (35.4-54.0 in.). The maximum left and right antler lengths reported were 137.2 and 137.2 cm respectively (Table 14). The maximum antler length recorded by Boone and Crockett for northern mountain woodland caribou in North America is 158.5 cm (62.4 in) for a caribou taken from the Mackenzie Mountains in 1978 (Byers and Bettas 1999). Eighteen of the top 50 mountain woodland caribou recorded in the 12th edition of the Boone and Crockett Club record book are from the Mackenzie Mountains; the highest scoring antlers hold 6th place (Boone and Crockett Club, on-line trophy database accessed 2011).

Table 14. Antler measurements of northern mountain caribou bulls harvested by non-resident hunters in the Mackenzie Mountains, 2010.

	Contour Length	
	Left Antler	**Right Antler**
Number Measured	107	107
Mean (cm)	113.5	113.6
Mean (in)	44.7	44.7
Standard Deviation (cm)	53.3	53.3
Standard Deviation (in)	21.0	21.0
Maximum (cm)	137.2	137.2
Maximum (in)	54.0	54.0
Minimum (cm)	90.0	92.0
Minimum (in)	35.4	36.2

Another measuring system for antlered animals is from Safari Club International (SCI), which has a unique all-inclusive record keeping system for measuring trophies, the most used system in the world. Unlike Boone and Crockett this system has no deductions or penalizing for asymmetry. Some outfitters prefer using this measuring system, especially for caribou, because it provides points for all tines and there are no deductions (Jim Lancaster, personal communication). Eight of the top 20 mountain woodland caribou recorded in the Safari Club International record book are from the Mackenzie Mountains, with a caribou harvested in 2006 holding second place in scoring (Safari Club International, on-line trophy database accessed 2011).

Since 1991 the percentage of bulls observed by clients in the Mackenzie Mountains has never been greater than 28%. This is a lower percentage than the cumulative 39% average adult bull component reported by Bergerud (1978) in his summary of eight North American caribou populations that were either non-hunted or hunted non-selectively (i.e., both males and females included in the harvest). Veitch *et al.* (2000c) classified 2659 of an estimated 5000 caribou in the central Mackenzie Mountains in August 1999 and reported only 25% of those animals were classified as males. Surveys made on the presumed rutting grounds of the South Nahanni caribou population in 1995, 1996, and 1997 reported 24, 28, and 20% of animals classified as males ≥1-year-old (Gullickson and Manseau 2000) and in 2001 reported 27% bulls (Gunn *et al.* 2002). A 2007 survey during the rut estimated 33.7 bulls:100 adult cows (R. Farnell and K. Egli, Yukon Territorial Government, unpublished data). A 2008 composition count during the rut in the same general area estimated a slightly higher ratio of 35.5 bulls:100 adult cows (Troy Hegel, personal communication).

Nagy (2011), using movement data from satellite collared northern mountain caribou in the Sahtu (Olsen 2000; 2001) determined ten activity periods. The breeding period, or rut, was defined as 9-25 October. This period was also the activity period with the greatest daily movement rate (Nagy 2011). Hunter observation data are collected prior to the breeding period and so was the survey in 1999 (Veitch *et al.* 2000c). Surveys conducted well before the rut or breeding period may underestimate the male component of the population. The surveys in 2007 and 2008 were conducted in late September and early October, just prior to the defined breeding period and findings were more comparable to what Bergerud (1978) reported. Based upon hunter observation data there is some evidence that the proportion of males differs between populations and that this difference has been consistent over the past 20 years (N. Larter, unpublished data). Further investigation would be required to explore demographic attributes of northern mountain caribou in the Mackenzie Mountains.

Northern mountain caribou in the Mackenzie Mountains are estimated to number between 13,000 and 18,000 from at least three separate populations shared between the Yukon and Northwest Territories: Bonnet Plume population (5,000 estimated), the greater Redstone population (5-10 000 estimated), and the greater Nahanni population (2-3,000 estimated) (Environment Canada 2011). They are subjected to an annual bull-selective non-resident harvest averaging 157 males per year (1991-2010). The resident harvest of northern mountain caribou in the Mackenzie Mountains also tends to be bull-selective (but not restricted to bulls) and is generally light (i.e., 30 animals/year); subsistence harvest includes both males and females, with the proportion of each dependent on the time of year that animals are harvested (J. Snortland, unpublished

data; Ken Davidge, personal communication). Subsistence harvesters in the Mackenzie Mountains include residents of both the NT and Yukon Territory; harvest is not generally reported.

Studies on the Redstone herd of northern mountain caribou were initiated in March 2002, with ten female caribou being equipped with satellite radio collars as part of a study of caribou in the central and north-central Mackenzie Mountains initiated by the SRRB (Creighton 2006; Olsen 2000; 2001; Olsen *et al.* 2001). A recent analysis of these location data indicates that some of the collared animals in the range of the Redstone herd are relatively sedentary year round, while others show the more typical seasonal migratory movements (John Nagy, personal communication).

Satellite radio collars were deployed on nine adult female caribou during March 2000 and October 2001 by the Yukon Department of the Environment (Jan Adamczewski, personal communication). These animals were believed to be part of the greater Nahanni herd. In October 2004, 18 female caribou were equipped with satellite collars along the Yukon-Northwest Territories border. These caribou were also believed to be from the greater Nahanni herd, but three animals were determined to be from the Finlayson herd. This was a co-operative study between Yukon Territorial Government, Parks Canada (NNPR) and the Wildlife Conservation Society (Weaver 2006). In October 2008, 30 female caribou were equipped with satellite collars along the Yukon-Northwest Territories border. Partners in this project include the Yukon Territorial Government, NNPR, Parks Canada, Park Establishment Branch, Parks Canada, Environment and Natural Resources, and the Canadian Parks and Wilderness Society, NWT Chapter (Troy Hegel, personal communication).

Alaska-Yukon Moose (*Alces alces gigas*)

Moose in the Mackenzie Mountains belong to the Alaska-Yukon subspecies of moose (also known as tundra moose) that occurs across Alaska, the Yukon, extreme northern British Columbia, and the Mackenzie Mountains, with the Mackenzies representing the eastern limit of the subspecies' range. This is the largest of the four subspecies of moose that occur in North America (Bubenik 1997). Tags to hunt moose were purchased by 30% (n=116) of non-resident hunters in 2010 (Table 6). At least 65% of tag holders hunted moose and harvested 75 bulls. This matches the highest level of harvest since 1991 when reporting started (range 32-75). Over the past four to six years, there have been more moose hunts and moose harvested (Figure 5; Appendix F). The mean (± SD) length of a moose hunt, determined from the 86 reports where hunters spent at least one day hunting, was 4.5 $\pm$ 4.0 days (range one to 18 days), similar to what was reported for previous years (Table 15).

The higher moose harvest in recent years is likely in part related to the change in ownership of outfitting zone D/OT/01. This zone is one of the largest, with an abundance of good moose habitat. Prior to 2005 few moose were harvested in this zone annually (<4 moose/year 1991-2004) because the majority of clients were interested in sheep hunting. Very few were interested in moose hunting. The new owner has a client base which includes a large number of European hunters who are specifically looking for trophy moose for European mounts.

Over the past few years ENR has been collecting, on a voluntary basis, front incisor teeth from moose harvested by hunters in the southern portion of the Mackenzie Mountains. These teeth are forwarded to Matson's Laboratory for aging. Age is

determined by counting the cementum annuli much like the growth rings of a tree. June 1 is used as the birth date for moose and caribou (Matson 1981). We currently have ages from 78 harvested moose. The ages range from 3 to 15 years (mean 7.4 years; median 7.0 years).

Table 15. Mean length, standard deviation, and range (in days) of moose hunts where at least one day was spent hunting from 2000-2010.

	2010	2009	2008	2007	2006
Number reports	86	68	82	80	72
Mean hunt length	4.5	4.2	3.6	4.0	3.6
Standard deviation	4.0	3.4	2.9	2.5	2.7
Range	1-18	1-14	1-16	1-9	1-11

	2005	2004	2003	2002	2001	2000
Number reports	85	49	60	46	42	48
Mean hunt length	4.4	4.8	3.9	3.6	3.7	4.4
Standard deviation	3.1	3.3	2.8	2.6	2.9	2.7
Range	1-14	1-12	1-14	1-12	1-12	1-12

The mean (± SD) tip-to-tip spread of measured antlers from bull moose harvested by in 2010 was 143.5 ± 48.9 cm (56.5 ± 19.2 in., n=65). This year we received the greatest number of antler measurements (n=65) since records have been kept (Table 16). This year's maximum recorded antler spread was 174.0 cm (68.5 in.), less than the maximum recorded antler spread of 196.9 cm (77.5 in.) for a record Alaska-Yukon moose taken in the NT in 1982. Two moose taken from the Mackenzie Mountains are in the top 20 Alaska-Yukon moose recorded in the record book of the

Boone and Crockett Club and hold places 15 and 20; the rest of the top 20 were all taken in Alaska and the Yukon. Another top 25 Alaska-Yukon moose recorded with the Boone and Crockett Club was harvested in the NT in 2008; it was accepted May 2009 and holds 23rd place. A moose harvested this year in the Mackenzie Mountains has the potential to be the next Pope and Young World Record moose.

Table 16. The yearly mean and range in measured bull moose tip-to-tip antler spread (cm).

	2010	**2009**	**2008**	**2007**	**2006**	**2005**
Measured (n)	65	53	63	62	56	53
Mean spread	143.5	143.5	145.5	141.1	141.3	144.9
Range	106-174	92-175	101-174	102-179	107-170	122-188
	2004	**2003**	**2002**	**2001**	**2000**	**1999**
Measured (n)	38	34	32	32	34	26
Mean spread	150.3	150.0	149.3	144.3	147.0	144.2
Range	127-174	107-165	103-178	113-165	127-179	109-166

From hunters' observations of moose during hunts we calculated ratios of 35.3 calves:100 adult females (cows) and 100.5 bulls:100 cows (Table 17; Appendix G). This is somewhat higher than the mean 29:100 calf:cow ratio recorded since 1995 and the tenth time in the past 16 years when the ratio has been ≥30:100. The ratio still remains lower than the 40-60:100 that is generally documented during early to mid-winter aerial surveys for northwestern moose (*Alces alces andersoni*) along the Mackenzie River in

the vicinity of the communities of Fort Good Hope (MacLean 1994a), Norman Wells (Veitch *et al.* 1996), and Tulita (MacLean 1994b) (Appendix G). However, these surveys were conducted after the major fall subsistence harvest and variable female harvest can certainly impact the interpretation of calf:cow ratios. As no research has been done on moose in the Mackenzie Mountains, we have no explanation for the apparent discrepancy in calf production, survival, or both between the mountains and the river valley. A survey of moose in the Norman Wells study area in January 2001 estimated a calf:cow ratio of 18:100 (ENR Norman Wells, unpublished data), and an aerial survey of the Mackenzie River Valley and vicinity in the Dehcho Region south from the Blackwater River to Jean Marie River conducted in November 2003 estimated 32:100 (Larter 2009). These studies indicate that low calf:cow ratios may not be restricted to the Mackenzie Mountains and that further studies are required to determine the cause(s). A program has recently been established in the Mackenzie and Liard River Valleys of the Dehcho to document calf:cow ratios annually in November (Larter 2009), and a large-scale moose survey, similar to the one in 2003 (Larter 2009), is planned for November 2011.

Table 17. Observations of moose reported by non-resident hunters in the Mackenzie Mountains, 2010.

Age/Sex class	Number of Hunters Reporting	Number Observed	Mean Number Observed/Hunter	Percent of Total Classified
Bulls	104	432	4.2	42.6
Cows	87	430	4.9	42.4
Calves	55	152	2.8	15.0

The bull:cow ratio of 100.5:100 reported for 2010 is lower than the 104:100 average from 1995-2010, but falls within the reported range of 76-137:100 (Appendix G). Bull:cow ratios from the Mackenzie Mountains continue to be generally higher than the range of 27-105:100 reported in the Yukon (R. Ward cited in Schwartz 1997) and 16:100 from heavily harvested populations in Alaska (Schwartz *et al.* 1992), and average of 46:100 Norway, range (25-69:100) (Solberg *et al.* 2002). There has been concern that low bull:cow ratios could influence conception dates, pregnancy rates and newborn sex ratios (Bishop and Rausch 1974; Crête *et al.* 1981; Solberg *et al.* 2002) and that management strategies should maintain a high bull:cow ratio (Bubenik 1972).

Studies on tundra moose in Alaska have not found evidence that moose populations with low bull:cow ratios have reduced reproductive rates (Schwartz *et al.* 1992); populations with a more skewed sex ratio had a relative rate of population increase greater than populations without a skewed sex ratio (Van Ballenberghe 1983). However, a recent study of eight heavily harvested moose populations in Norway indicated a relationship between declining recruitment rate and skewed adult sex ratio (Solberg *et al.* 2002). Based upon hunter observations since 1995, there is no indication of any decreasing trend in the bull:cow ratio of moose in the Mackenzie Mountains,

hence the adult sex ratios are an unlikely factor in the low calf:cow ratios reported. The reported sex ratios may have an inherent bias towards a greater number of bulls if harvesters consistently spend more time searching for moose in areas frequented more by large males than females.

Mountain Goat (*Oreamnos americanus*)

Sales of mountain goat tags show more annual fluctuation than any other ungulate species harvested by non-resident hunters in the Mackenzie Mountains, range 6-50 during 1995-2009 (Table 5) with a mean annual harvest of eight goats (range 1 to 21) over the same time (Appendix F). In 2010, mountain goat tags were purchased by 45 (12%) of non-resident hunters. Thirteen goats were harvested in 2010; ten billies and three nannies. This years' harvest was down from that of the three previous years (Appendix F). The mean (± SD) length of a goat hunt, determined from the 13 reports where hunters spent at least one day hunting, was 3.2 ± 1.9 days (range one to seven days), within the range of what was reported in previous years (Table 18).

Table 18. Mean length, standard deviation, and range (in days) of goat hunts where at least one day was spent hunting from 2000-2010.

	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Number reports	13	22	21	27	12	18	8	6	4	2	1
Mean hunt length	3.2	2.5	3.0	2.7	2.8	3.8	3.9	3.0	2.8	1.5	3.0
Std Dev	1.9	2.0	1.8	1.7	1.5	2.8	1.6	2.6	1.9	0.7	n/a
Range	1-7	1-8	1-8	1-6	2-6	1-14	2-6	1-8	1-5	1-2	3

Mountain goats are known to inhabit five of the eight outfitting zones in the Mackenzie Mountains, occurring almost exclusively below 63° 00' N (Veitch *et al.* 2002). They are most numerous in high relief terrain along the Yukon-Northwest Territories border between 61° 00' and 62° 00' N. However, since 1995 we have received hunter observations or harvest reports of goats from only four of those outfitter zones - D/OT/01, D/OT/02, S/OT/03, and S/OT/04 (see Figure 1). In 2010, observations of mountain goats by hunters came from just two zones, D/OT/01 (n=53), and D/OT/02 (n=186), but goats were harvested from a third zone, S/OT/03. We estimated 78.3 kids and 46.2 billies per 100 nannies based upon this year's hunter observations. The kid:nannie ratio being higher and the billie:nannie ratio being lower than the average 61.4:100 and 67.4:100, respectively, reported since we requested mountain goat observations in 2002 (Appendix H).

In 2005, we started to estimate the age of harvested goats based upon counting horn annuli, and have tried to age as many harvested goats as possible since then. Of the 88 goat (77 billies and eleven nannies) ages we have to date the age range is 2.5 to 15.5 years with 47 aged <8 years, 41 aged >8 years, and 25 animals >10 years (Figure 6). Of the 12 goats (ten billies and two nannies) aged in 2010, three were aged >10 years. The longest horns from a mountain goat taken in 2010 were 24.5 cm (left) and 24.5 cm (right). No mountain goats from the NT are listed in the 11th edition of the Boone and Crockett Club record book (Byers and Bettas 1999). Based upon the horn age and length data over the past five years there is a somewhat linear relationship between age and horn length from 2.5-8.5 years, but after that age there is almost no

relationship. This relationship implies that large horned animals are found over a wide range in animal ages (Figure 6).

There is some evidence that goat numbers and distribution have been increasing in zone D/OT/02 in the southern Mackenzie Mountains (Larter 2004; Jim and Clay Lancaster, personal communication; Werner Aschbacher, personal communication). The total number of goats observed has been increasing in recent years and billies have been observed in places they had not been seen previously in zone D/OT/02 (Clay Lancaster, personal communication; Appendix H).

In a 2.5 hour rotary-winged survey of zone D/OT/02 on 11 September 2006, 88 goats were observed (38 billies, 27 nannies, 19 kids, and 4 yearlings), producing estimates of 140.8 billies and 70.4 kids per 100 nannies (N. Larter, unpublished data). This survey was conducted in an area that could not be surveyed during a 2004 aerial survey and provided similar numbers of goats and ratio estimates as the 111 billies and 71.4 kids per 100 nannies from that 2004 survey (Larter 2004). These observations support the contention of increasing goat numbers and distribution. ENR will continue to work with outfitters in zones D/OT/01 and D/OT/02 to complete additional counts as part of the work required to update the current status of mountain goats in the Mackenzie Mountains. Counts would occur in mid-summer and be conducted later in the day rather than during the morning and early afternoon. Mountain goat nursery groups are more active and visible above treeline at those times (Werner Aschbacher, personal communication; Jim and Clay Lancaster, personal communications).

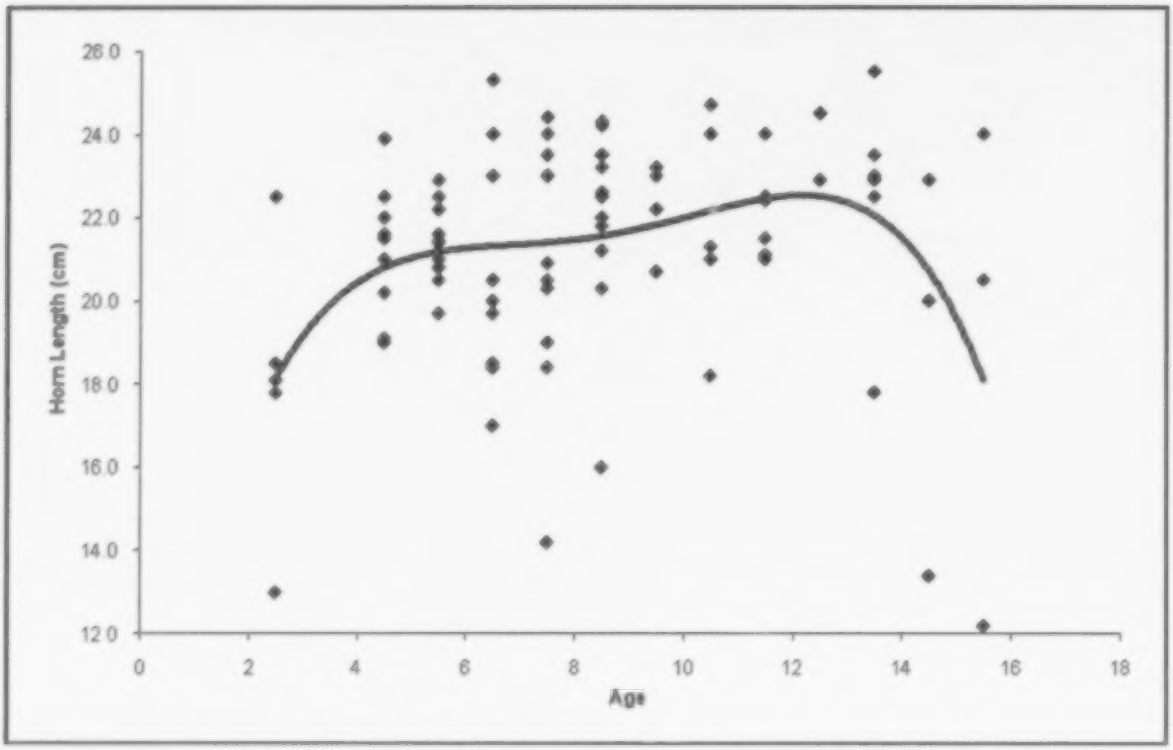


Figure 6. The relationship between the horn length (cm) and age (based upon horn annuli) of 88 mountain goats harvested in the Mackenzie Mountains 2005-2010. Line of best fit is a 4th order polynomial.

The increased harvest of mountain goats since 2004 (see Appendix F) may be related to changes in accessibility to the more remote and rugged parts of the various outfitter ranges where goats are resident. The use of rotary aircraft in recent years has permitted outfitters to get into some areas of their zones where they have never been before, areas where goats have been found. This increased accessibility to areas of untouched goat range has likely had some effect on the increased success in goat harvest.

Wolf (*Canis lupus*)

Wolf tags were purchased by 77% (n=294) of non-resident hunters in 2010 (Table 6). This is the greatest number of tags and the highest proportion of hunters purchasing tags in any year since the 1995 reporting of observations began (Table 19). At least 25% (n=73) of tag holders actively hunted wolves, with 19 wolves being harvested (eight males, nine females and two unknown sex) (Appendix F). The wolf harvest was similar to that from 1991-2009 (mean 14, range 7-23). Hunters reported spending one to 14 days actively hunting wolves (mean ± SD of 5.5 ± 3.13 days). This is the second year that wolves were hunted during the winter, four wolves were harvested in April 2011 in zone S/OT/01.

The number of wolves observed in 2010 (n=203) falls within the range of observations from previous years. There is no relationship between the number of wolves observed/year and annual harvest nor does the number of tags purchased/year explain annual differences in wolf observations (Table 19). Only 1.5% of responding hunters indicated that they believed wolf numbers were high, generally less than in previous years, and all those comments came from zone G/OT/01. 2000 was the first year that hunters commented on wolf numbers in the wildlife observation forms. The number of hunters reporting since 2001 has been consistently higher than in previous years, which is attributed to a change in how we defined hunter reporting. For data collected after 2001, we assumed that all returned observation forms where there was a blank, a zero, or a dash in the box indicating the number of wolves observed was a report of no wolves being observed. When looking at the forms this seemed like a

reasonable assumption. This assumption may well be invalid for previous years' data and would bias the post 2001 values to be higher than the previous years.

Table 19. Observations of wolves reported by non-resident hunters in the Mackenzie Mountains, the number of wolves harvested and the number of wolf tags purchased,1995-2010.

	2010[1]	2009[1]	2008[1]	2007[1]	2006[1]	2005[1]	2004[1]	2003[1]
Number hunters reporting	203	241	239	244	239	254	244	203
Number wolves observed	203	167	260	262	202	245	317	200
Number hunters seeing ≥1	61	65	76	88	84	76	81	74
Number harvested	19	20	17	12	23	19	18	12
Number wolf tags	294	252	228	227	201	204	166	207
	2002[1]	**2001**	**2000**	**1999**	**1998**	**1997**	**1996**	**1995**
Number hunters reporting	197	142	116	103	148	141	76	119
Number wolves observed	249	215	228	142	148	200	186	269
Number hunters seeing ≥1	69	65	61	40	57	76	26	26
Number harvested	11	15	14	11	9	17	11	14
Number wolf tags	159	137	145	89	165	209	194	72

[1] Change in reporting since 2002 may have resulted in the number of hunters reporting for 1995-2001 being artificially low, see text.

Wolverine (*Gulo gulo*)

Wolverine tags were purchased by 45% (n=171) of non-resident hunters in 2010 (Table 6). This is the greatest number of tags and the highest proportion of hunters purchasing tags in any year since the 1995 reporting of observations began (Table 20). At least 26% (n=44) of tag holders actively hunted wolverine, three wolverine were harvested in 2010 (one male, and two unknown sex). Hunters reported spending from 1 to 16 days actively hunting wolverine (mean ± SD of 6.6 ± 3.28 days). Hunters reported seeing pairs of wolverine on three occasions and 25 observations of solitary wolverine.

Observations were reported from seven of the eight outfitter zones this year with most observations coming from D/OT/01, D/OT/02, S/OT/01 and G/OT/01 (Figure 6). Historically, wolverine observations have been mostly of solitary animals with few family groups being observed. The number of animals observed this year continues an increasing trend from 2007, and is similar to the numbers observed during 1995-1999 and 2004-2006 (Table 20; Figure 7). Wolverine numbers are believed to be declining in other parts of their range in the Northwest Territories (Suzanne Carrière, personal communication); our observations since 1995 in the Mackenzie Mountains are equivocal.

There is no relationship between the number of wolverine observed/year and annual harvest nor does the number of tags purchased/year explain annual differences in wolverine observations (Table 20). Wolverines occur throughout the Mackenzie Mountains, but sightings are considered rare. Most wolverine observations are made in hunting zones G/OT/01, S/OT/01, and S/OT/05.

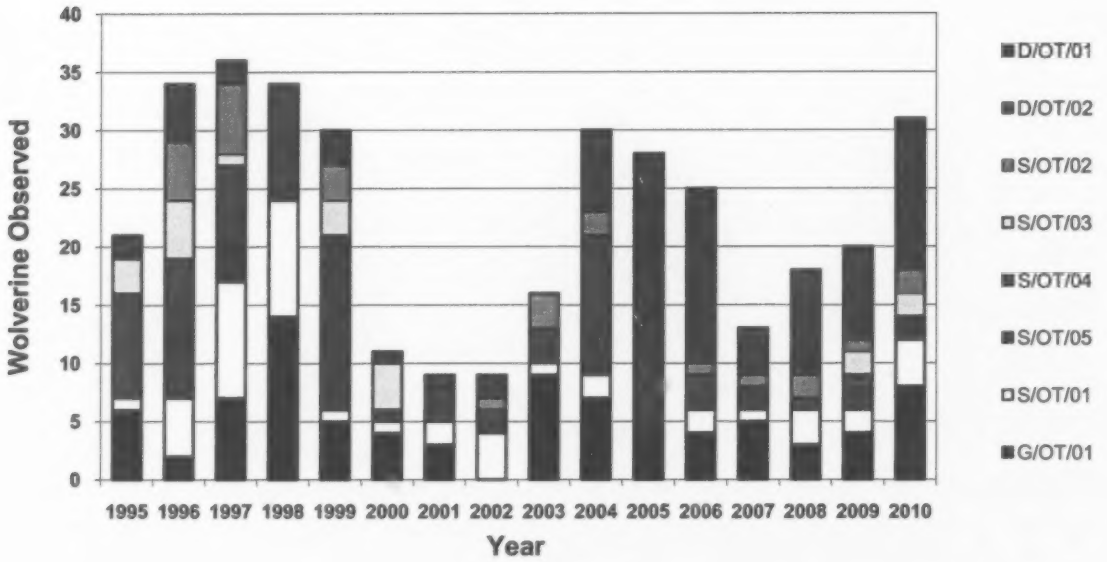


Figure 7. The number of wolverine observed by hunters from 1995-2010 and the outfitter zones where the observations occurred. Data are based upon voluntary hunter observation forms.

Table 20. The number of reported observations of wolverines, the number of wolverines harvested, the number of hunters with wolverines tags, the percentage of total hunters with wolverine tags, and the total number of hunting licences purchased for 1995-2010.

Year	2010	2009	2008	2007	2006	2005	2004	2003
Reported Observed	31	20	18	13	25	28	30	12
Number Harvested	3	3	1	0	1	1	0	0
No. Wolverine Tags	171	133	111	150	108	154	89	141
% Wolverine Tags	45	39	28	37	27	39	26	40
Total Hunting Licences	384	339	399	405	407	394	337	347
Year	**2002**	**2001**	**2000**	**1999**	**1998**	**1997**	**1996**	**1995**
Reported Observations	9	9	11	30	34	36	34	21
Number Harvested	1	2	0	3	0	1	4	1
No. Wolverine Tags	97	83	78	65	99	135	114	35
% Wolverine Tags	29	26	23	20	29	38	29	11
Total Hunting Licences	338	332	332	321	345	352	387	344

Black Bear (*Ursus americanus*)

This year 28 tags were purchased by non-resident hunters for black bears, the second highest total since records have been kept in 1995 (Table 6). This year there were no black bears harvested in the Mackenzie Mountains. Black bears are seen relatively rarely seen in the Mackenzie Mountains and in most years are reported only from south of 63° 00 N. In 2010, 29 black bears (29 adults and no cubs) were observed based upon returned voluntary hunter observation forms. Bears were observed in outfitter zones D/OT/01 (7 adults), D/OT/02 (18 adults), S/OT/02 (1 adult), S/OT/03 (1 adult) and S/OT/05 (2 adults), with some observed north of 63° 00 N (Table 21). The number of black bears observed in 2010 falls within the range of 17-56 observed during 2003-2009 (Table 21). As with the other post 2001 carnivore data, we assumed that all returned observation forms where blanks, zeroes, or dashes occurred in the boxes indicating the number of carnivores observed was a report of no carnivores being observed. This assumption is likely invalid for previous years' data and likely somewhat inflates the post-2001 values relative to 1996-2001 values.

Table 21. Observations of black bears reported by non-resident hunters (including non-hunting guides) in the Mackenzie Mountains, 1995-2010.

	2010[1]		2009[1]		2008[1]		2007[1]		2006[1]		2005[1]		2004[1]		2003[1]	
	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad
Total # Observed	0	29	3	14	8	48	4	34	2	27	4	21	1	23	3	34
% of Total Observed	0	100	18	82	14	86	11	89	7	93	16	84	4	96	8	92
No. Hunters Reporting	203	203	194	194	244	244	244	244	239	239	256	256	229	229	191	191
No. Hunters Saw at Least 1	0	8	3	10	3	10	2	17	1	14	3	18	1	19	2	21
Maximum # Observed	0	2	1	3	3	4	2	8	2	11	2	2	1	3	2	7

	2002[1]		2001		2000		1999		1998		1997		1996		1995[2]
	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	All Bears
Total # Observed	3	17	0	7	2	15	4	7	0	15	2	3	1	10	11
% of Total Observed	15	85	0	100	12	88	36	64	0	100	40	60	9	99	nil
No. Hunters Reporting	199	199	127	130	88	93	87	89	121	124	96	96	6	14	44
No. Hunters Saw at Least 1	2	14	1	7	1	10	2	6	0	8	2	3	1	9	9
Maximum # Observed	2	3	0	1	2	3	2	2	0	3	1	1	1	2	2

[1] Change in reporting for 2002 may have resulted in artificially lower numbers of hunters reporting for 1995-2001, see text.

[2] All bears not separated out by cubs and adults.

Grizzly Bear (*Ursus arctos*)

The Mackenzie Mountains have been closed to non-residents for hunting grizzly bears since 1982 and resident hunters have been restricted to one bear per lifetime since the same year (Veitch 1999). This year a resident hunter, using an outfitter, harvested a grizzly bear in zone S/OT/03 during the 15 August – 31 October hunting season. It is clear from the comments made by hunters on voluntary observation forms that, despite the lack of hunting opportunities, grizzly bears remain a subject of considerable interest for non-resident hunters and their guides in the Mackenzie Mountains (Appendices C and D). Consistent with the past 12 years, some hunters in 2010 reported the loss of meat, capes and food to grizzly bears, and some commented that there were too many grizzly bears, and that a hunt should be considered. Outfitters also continue to mention camp and equipment damage by grizzly bears both during and after the season. Even though moose calf numbers, based upon hunter observations, are generally lower in the Mackenzie Mountains than those reported in the Mackenzie Valley, and predation by grizzly bears could be a potential cause (Ballard 1992), there were few hunter comments indicating low moose or caribou calf numbers. A frequent comment of guided hunters is that bears have lost their fear of humans because of a lack of hunting and they were concerned that this was a human safety issue. Although there have been no documented injuries from grizzly bear attacks in the Mackenzie Mountains since the closure of the non-resident grizzly bear hunting season (Veitch 1999), there were five incidents in 2010 in the southern Mackenzie Mountains where grizzlies claimed either meat or hides from kills while guides were in the vicinity or while they were at camp. In most instances the grizzlies came at night, took the meat, and left

without incident (Carl Lafferty, personal communication). Since 1993 there have been 57 nuisance grizzly bears killed, the majority in the Sahtu (n=35) and Gwich'in (n=14) regions with 8 in the Dehcho. Six of those eight kills in the Dehcho occurred in the past 5 years (ENR Norman Wells and Fort Simpson, unpublished data). No nuisance grizzly bears were killed this year in the Mackenzie Mountains, a first since 1993. To minimize human-grizzly bear interactions electric fences have been used at main camps, temporary camp use has been reduced, clean camp policy has become standard, and some known high-use grizzly bear areas have been avoided.

While the mean number of adult grizzly bears observed by hunters has fluctuated around a mean of 302 from 1996-2010, the cub to adult ratio calculated from the hunter observations has shown marked fluctuations, but with limited periodicity (Figure 8; Table 22). There was a peak in 2000, with 40 cubs/100 adult bears observed, followed by a decline to a low of 14 cubs/100 adult bears in 2003. Subsequently there was an increase to 33 cubs/100 adult bears in 2006, followed by a drop in 2007, but with a return to over 30 cubs/100 adult bears for the next two years. In 2010 we report 28 cubs/100 adult bears (Figure 8; Table 22). Because cub grizzlies in the Mackenzie Mountains tend to stay with their mothers for three years (Miller *et al.* 1982), reported observations of 'cubs' likely refers to cubs-of-the-year, yearlings, and two-year-old bears. Miller *et al.* (1982) documented a low reproductive rate for female grizzly bears in the Mackenzie Mountains, with no sows less than eight-years-old producing cubs, an average inter-litter interval of 3.8 years, and a mean litter size of 1.8. The 'cubs'/100 adult bears determined from reported hunter observations during 1996-2010 shows some periodicity, but whether it matches an underlying four year interval is debatable

(Figure 8). What is currently happening may or may not be similar to what was reported by Miller *et al.* (1982) during 1973-1977 when there was non-resident hunting of grizzly bears.

We estimated the mean litter size from hunter observation reports by analyzing just those observations of groups of grizzly bears where cubs were present with only one adult. The estimated mean litter size in 2010 was 1.6, which falls within the range of 1.4-2.0 reported from 1996-2010. The 1.6 litter size reported for 2010 falls between the mean found by Miller *et al.* (1982) and the 2.2 reported for grizzly bears of Kodiak Island, Alaska (Troyer and Hensel 1964). The demographic parameters of Mackenzie Mountain grizzly bears estimated during 1996-2010 remain generally comparable to those reported during 1973-1977 by Miller *et al.* (1982).

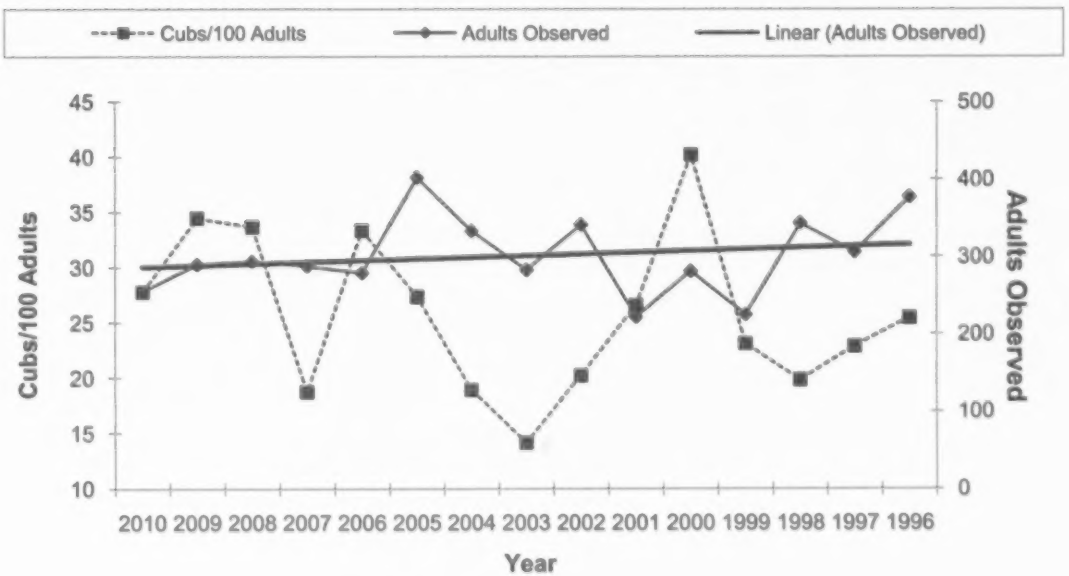


Figure 8. The number of 'cubs'/100 adults and the total number of adult grizzly bears observed by hunters from 1996-2010. Data are based upon voluntary hunter observation forms. The linear trend of total adult bears observed during the same time period is indicated

Table 22. Observations of grizzly bear reported by non-resident hunters in the Mackenzie Mountains, 1995-2010; total number of bears observed, percent of cubs/adults, number of hunters reporting grizzly observations, number of hunters seeing at least one cub/adult, the mean and maximum number of cub/adults observed. [1] All bears were not separated out by cubs and adults.

	2010		2009		2008		2007		2006		2005		2004		2003	
	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult
Total # Observed	71	255	100	290	99	294	54	288	93	279	110	402	63	333	40	283
% of Total #	22	78	26	74	25	75	16	84	25	75	21	79	16	84	12	88
# Hunters reporting	33	104	47	109	48	139	28	127	50	122	49	150	34	131	19	120
# Hunters saw ≥1	25	53	36	64	31	64	17	56	32	70	10	65	15	57	9	53
Mean # Observed	2.2	2.5	2.1	2.7	2.1	2.1	1.9	2.3	1.9	2.3	2.0	2.3	1.9	2.5	2.1	2.4
Max. # Observed	5	11	6	20	6	12	5	15	5	12	10	16	4	15	12	7

	2002		2001		2000		1999		1998		1997		1996		1995
	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	All Bears[1]
Total # Observed	69	341	59	222	113	281	52	225	68	343	70	306	96	377	389
% of Total #	17	83	21	79	29	71	19	81	17	83	19	81	20	80	nil
# Hunters reporting	34	128	136	171	108	131	98	117	139	177	110	170	49	132	138
# Hunters saw ≥1	11	48	28	104	51	97	28	81	31	105	32	129	46	129	123
Mean # Observed	2	2.7	0.4	1.3	1.1	2.1	0.5	1.9	0.5	1.9	0.6	1.8	2.0	2.9	2.8
Max. # Observed	8	20	5	10	8	12	4	12	6	16	12	17	5	15	16

ACKNOWLEDGEMENTS

We appreciate the continued co-operation from the outfitters operating in the Mackenzie Mountains in 2010, and thank them for the extra efforts they made in completing, signing, and sending us their harvest reports and meat distribution forms. We especially want to thank those outfitters who spent additional time compiling and sending additional information so that this report could be completed in a timely fashion.

We thank Renewable Resources Officers and clerks with ENR in Norman Wells, Fort Simpson, and Fort Liard for collecting and organizing data from non-resident hunters in their respective offices. We also greatly appreciate the efforts, interest, and co-operation shown by our visiting hunters and the more than 80 guides that completed the forms, reported observations of animals seen, and did the various antler and horn measurements. We would particularly like to thank those hunters that took the time to write comments about their hunting experience.

We thank Mary Knox for ensuring that all data she received by the Sahtu ENR office was forwarded to the Fort Simpson ENR office, and Jeff Walker for providing the nuisance bear data. John Nagy provided unpublished data from Richardson Mountain Dall's sheep work and a reanalysis of satellite collared mountain caribou data. We gratefully acknowledge the Boone and Crocket Club for providing us with access to their on-line trophy database and Safari Club International for providing us with caribou data from their on-line trophy database. Matson's Laboratory aged all of the moose teeth.

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Appendix A.

Outfitters licenced to provide services to non-resident hunters in the Mackenzie Mountains, NT – 2010.

D/0T/01 – *SOUTH NAHANNI OUTFITTERS LTD.*

Werner and Sunny Aschbacher
PO Box 31119
Whitehorse, YT Y1A 5P7
Ph: (867)-399-3194
Fx: (867)-399-3194
e-mail: info@huntnahanni.com
website : www.huntnahanni.com

D/0T/02 – *NAHANNI BUTTE OUTFITTERS*

Clay and Jim Lancaster
PO Box 3854
Smithers, BC VOJ 2N0
Ph: (250)-846-5309
2nd Ph: (250)-263-9197
e-mail: jladventures@xplornet.com
website:
www.lancasterfamilyhunting.com

G/0T/01 – *ARCTIC RED RIVER OUTFITTERS*

Tavis Molnar
PO Box 1
Whitehorse, YT Y1A 5X9
Ph: (867)-633-4934
Fx: (867)-633-4934
e-mail: arcticred@canada.com
website: www.arcticred-nwt.com

S/0T/01 – *GANA RIVER OUTFITTERS*

Harold Grinde
P.O. Box 528
Rimbey, AB T0C 2J0
Ph: (403)-357-8414
e-mail: ganariver@pentnet.net
website: www.ganariver.com

S/0T/02-*MACKENZIE MOUNTAIN OUTFITTERS*

Stan and Helen Stevens
P.O. Box 175
Dawson Creek, BC V1G 4G3
Ph: (250)-786-5118
Fx: (250)-786-5404
e-mail: stevens.mmo@pris.bc.ca
website: www.mmo-stanstevens.com

S/0T/03 – *RAM HEAD OUTFITTERS*

Stan and Debra Simpson
P.O. Box 89
Warburg, AB T0C 2T0
Ph: (780)-848-7578
Fx: (780)-848-7550
e-mail: ramheadoutfitters@hotmail.com
website: www.ramheadoutfitters.com

S/0T/04 - *NWT OUTFITTERS*

Eric and Lorna Mikkelson
PO Box 106
Lazo, BC V9N 8Z8
Ph: (888)-293-2299
Fx: (250)-897-0054
e-mail: nwtoutfitters@shaw.ca
website: www.nwtoutfitters.com

S/0T/05 - *REDSTONE TROPHY HUNTS*

Dave Dutchik
P.O. Box 18
Pink Mountain, BC VOC 2BO
Cell: (250)-261-9962
Ph/Fx: (250)-772-5992
e-mail: redstone@netkaster.ca
website: www.redstonehunts.com

Appendix B.

Summary of fees, bag limits, and seasons for big game species available to non-resident hunters in the Mackenzie Mountains, NT - 2010. [Note: all prices are in Canadian funds.]

Species	Status	Tag Fee	Trophy Fee	Bag Limit	Season
Black Bear	Non-resident	$40.00	$200.00	1 adult bear not accompanied by a cub	15 Aug - 31 Oct 15 Aug – 30 June
	Non-resident alien	$100.00	$200.00		
Woodland Caribou	Non-resident	$40.00	$400.00	1	25 Jul - 31 Oct
	Non-resident alien	$100.00	$400.00		
Mountain Goat	Non-resident	$40.00	$400.00	1	15 Jul - 31 Oct
	Non-resident alien	$100.00	$400.00		
Moose	Non-resident	$40.00	$400.00	1	1 Sep - 31 Oct
	Non-resident alien	$100.00	$400.00		
Dall's Sheep	Non-resident	$40.00	$400.00	1 adult male with min. ¾ curl	15 Jul - 31 Oct
	Non-resident alien	$100.00	$400.00		
Wolf	Non-resident	$40.00	$200.00	1 or 2[2]	25 Jul - 31 May
	Non-resident alien	$100.00	$200.00	2	1 Aug - 15 Apr
Wolverine	Non-resident	$40.00	$200.00	1	25 July - 31 Oct
	Non-resident alien	$100.00	$200.00		25 July - 31 Oct

Source: Department of Environment and Natural Resources. 2010. Northwest Territories Summary of Hunting Regulations. Department of Environment and Natural Resources, Yellowknife, NT. 30 pp.

[2] One wolf limit from D/OT/01-02 and G/OT/01, and 2 wolf limit from S/OT/01-05.

Appendix C.

Comments provided from non-resident hunters in the Mackenzie Mountains, NT on voluntary Hunter Wildlife Observation Report forms, 2010. We have not printed actual names of outfitters or their guides (XXX).

Probably the best outfitter in NWT.

Great hunt, weather made hunting a challenge.

For me, one of the best run outfitters I've had the chance to hunt with. I will be back and will recommend to others. Sign of grizzly bears is very abundant. There should be an open season for grizzly here (NWT, Mackenzie Mtns.) as there numbers are great and they have no fear of man. They need to be hunted!

To hard for me.

Outfitter is doing an amazing job with game management; support them as much as you can!

Great hunt, awesome hunt! Very good guide, perfect base camp with great food and treatment. Too many grizzly bear getting into camp. Two of them charged 30 yards!

The outfitter, his wife, cook staff and guides were excellent. I plan to return, and would recommend the Mackenzie Mountains to all my hunting friends and anyone who wanted a great quality hunt.

This is a great area managed very, very well, mature high quality animals are available and taken. However, the grizzly bears seem to be over populated and would be well served with a limited hunt. I had three encouters with bears that could have ended badly if not scared off.

Grizzlys in camp twice (different areas), which is not very nice! I felt defenceless!

Excellent trip!

Hunted together with XXX.

I think there are too much Grizzlys. Otherwise excellent hunt and outfitter and guides super organized.

Hunted together with XXX

Good experience.

Thank You!

Very excellent hunt and outfitter organization! Hunted together with XXX!

Hunted together with XXX.

To hard for me.

Great hunt, I feel the extra $200.00 for kill fee after price is agreed to is a very unprofessional way to do business. There are other alternatives to hunt eslewhere. Everything else with XXX was spectacular.

Amazing place.

Very high cost in licence increase. My guide was a super, great, smart young man that made this the best hunt I have ever had.

Excellent hunt, thank you!! No happy about trophy fee extra.

Beautiful country.

Excellent oufitter, do not agree with increase in tags, it will make it harder for me to come as often.

Licence increase in July??? Why.

Very happy with all matters! But not happy with fee & increased licence & permits.

Should have given more notice on licence increase.

Doubled licence fees without notice was a surprise.

Passed on a bunch of rams, never saw a Boone and Crockett sheep so he did not shoot.

First class operation, very professional and abide by the rules. Knees swelled up on goat hunt and quit hunt.

Outstanding hunt, licence increase surprise.

Licences charged on July 1st are really unexpected

Change in licence fees just before the start of the season was poor start to hunt.

Excellent hunt. Did not like licence increase.

Absolute quality from guides, equipment, main camp and overall hunting experience. Safety and regulation guidelines were strictly monitored. I was very disappointed to see that a "kill fee" was implemented July 1.

Excellent outfitter. Top quality hunt with above average animals. The increase in licence fees during the hunting season created a bit of a problem but all in all top notch.

Customer satisfied!

Not impressed with the increase of hunting licences before the hunting season, as well it is a shame that the park is

taking over a beautiful hunting area.
Not very happy with the increase in trophy fee's for 2010. It concerns me tha the size of the park increase will limit hunting (quality) area's in NWT. Hunter's like myself will then travel to other area's outside of NWT.
Bowhunter, no kill.
Hunt of a lifetime, great outfitters.
Good hunt, bad weather.
Colder than hell. Bad weather.
Had a great hunt, beautiful country.
Not good timing to change licence fee, just before season.
It wasn't good timing to change the licencing fee.
Can't find a reasonable explanation for the $200 increase in trophy fee.
Great Outfitter!!
Good outfitters. Lots of animals.
Had a super trip. It truly was the adventure of a lifetime. XXX are a top notch group. I will be back again.
Great hunt.
Do not make this a non hunting park, totally sustainable.
Sore knee, quit hunt early
Awesome place please keep hunting available here.
Great hunt, great outfitter.
Why would you turn this into a national park + not allow hunting? What a waste!
I did not like the increased trophy fee with no notice and it is a shame to turn such a beautiful hunting area into a park that we can't hunt anymore there is no negative impact from hunting in this area at all.
Exceptional hunt, beautfiul area, outfitter was awesome. Sow grizzly stalked within 30 yrds, fired warning shot, bear never really paid attention. Sure would be nice to be able to hunt a few a year.
Lots of good young rams + high number of lambs:ewes.
Ram lower jaw worn badly and teeth were exposed to the side.
All animals appeared in good condition.
Lots of grizzlies stalked a few times close lots of sheep. Wolf season did not open til the day he flew out at 9:30AM shouldn't of sold him a tag!.
Sheep looked good except Ram that we killed sick old Ram, good weather, good caribou.
Ram had lots of black hairs, didn't see a lot of caribou calves. Saw tons of wolves and wolf sign. Had bears come into 2 kills.
Lots of animals good condition, lots of Grizzlies.
Lots of grizzlies running around, sheep + caribou looking good shape.
All animals looked in great shape.
All animals looked in great shape.
No rams 10 years or older to shoot all animals in good health, good lamb crop. Lots of young rams.
Seen lots of good caribou, just too far away from air strip to shoot.
Animals in good condition, haven't seen many cow/calf caribou.
Most of rams younger rams all animals in good condition.
Sheep looked good lots of feed, caribou look in good shape.
XXX is top notch!! Best outfitter I have ever hunted with. All animals looked in good condition.
All animals looked in great condition.
Ram had black hair throughout.
Animals in good condition. Saw a sow and cub grizz on a caribou kill. Lots and lots of grizz and wolf sign. Found a old fuel barrel from way back.
Saw lots of caribou, and a few ewes and lambs, everything seemed healthy.
Saw lots of caribou they all seemed healthy.
All animals looked in good condition.
All animals looked in good condition.
All animals seemed to be in good condition.
Lots of wolves, lots of bears
Caribou way up high on mountains and travel a lot.
Lots of caribou.

Lots of caribou.
All animals looked healthy and appeared in good condition.
Seen some old legal rams just not big enough for hunter. Lots of young rams.
All animals looked like they were in great condition.
It sure would be nice to be able to hunt a limited amount of grizzlies each year, so they may possibly develop some respect for humans. Seen 8 bears in 10 days and my client and I were stalked twice by bears to within 50 yards.
Great experience - great people - great food. Breathtaking scenery - quiet ! No polution.
Had good time.
Treated well - nice country. Lots of grizzly sign - think it could support a season!
One of the best hunts I've enjoyed in all of many years of hunting, not to mention the thrill of a 412" caribou kill. The hospitality of the XXX was excellent, my wife XXX + I hope to be back again.
Beautiful country many game a lot of bear sign, sheep everywhere.
XXX is about the absolute most professional outfitter in the Territories. The overall experience is consistently superior. A great thank you to XXX + crew, it is like coming home to a special place.
Excellent hunt, camp + atmosphere! Can't wait to return. I would highly recommend this experience to anyone wanting a fair chase superb hunt.
Enjoyed my trip. Excellent Outfitter & staff.
XXX and XXX provided us with an incredible experience. The food, accommodations and hunting was superb! Everyone was courteous and professional! We cannot wait to come back!
Excellent hunting. Keep up the great work.
Great people, excellent food, very relaxing trip. Can't wait to return. Guide was very knowledgeable and quality of animals was phenominal. Thanks again for the memories.
Great hunt + experience.
XXX is an exceptional operation that I will definitely return to hunt with. Very professional group of people.
The XXX are #1, first class operation, great honest, hard working outfit!!! I'm coming back.
Great experience again, making great bowhunting memories. See you soon. Thanks for all the great work you do.
Fight the expansion of the Nahanni Park or allow hunting there. Get a grizzly season. Archery hunter - stalked rams but no shots. Very bad weather.
Excellent - Awesome, land and people. Donnie did not hunt - he accompanied a friend.
XXX and his team run a great outfit. The Territory is excellent.
Beautiful terrain with wonderful landscape very natural and wild. Plenty of animals, excellent organization, great people.
Incredible number of sheep.
I have hunted with several outfitters extensively around the world. XXX and XXX do an exceptional job. They are first class people and are great operators. Everything they said was true from the time we booked to the time we finished our hunt. I would recommend them to anyone. It was a first class hunt and I hope to be back soon.
A great experience. Friendly knowledgeable and fabulous country, scenery is spectacular!
Very good outfitter, well organized and they take quality animals and are selective on what they allow the hunter to shoot.
After harvested sheep saw 80-100 sheep flying back to basecamp.
Outstanding area and outfitter.
Hunt of a lifetime for me. Beautiful hunt, will return again.
In being a Canadian resident, and comparing you lincence/kill fee to those in my province I find your licence/kill fees extraordinarily high. I can understand these levels for non-resident aliens, however it appears unjust for Canadian residents. I would be most appreciative if somebody could give me a response as to why a 100% fee increase was instituted.
The prep and service from our guides + team were excellent. The quality of animals and age exceeded our expectations and I plan to return soon. Bow kill 14 years old
Everything about the hunt was superb, all was very fluid.
Excellent hunting experience.
Thank you for a wonderful trip. This was "the trip of a lifetime". Everyone I met was friendly and helpful. I will be back. My outfitter did an exceptional job providing a great guide and cook. We all shared many fond memories.
Fantastic! Everyone saw grizzly's but me - they say they are many out there. Great time.
Great accomodations - great guide - fantastic transportation (argo!) - very good people!
Everything have been a great experience, thank you.
Grizzly bear took my sheep skin from camp.

The best outfitter and area.
Very nice wilderness.
I had a great time, it was an exoerience.
Awesome country. Animals all appear to be in good condition. Although about 60% of moose and caribou cows do not have calves.
Beautfiul country, lots of game.
This outfitter is doing an excellent job of managing for recruitment & trophy animals.
Quality and Quality were both good. Condition of animals was excellent.
All animals observed were in good physical shape. No visible scars were observed.
Quite pleased with the number & health of the animals that I observed. Our guides were very knowledgeable with regards to locating quality animals.
Great experience, beautiful country.
Heaps of game and a great place to hunt. I will be back.
Good numbers + opportunities on sheep + caribou in few hunt days
Great food - great hunt- most incredible journey.
Good quality and in good quantity.
Caribou were very good. The moose seemed very healthy. Caribou cows + calves had healthy coats, bulls were fat.
Wonderful experience. The numbers of caribou was very above my expectations. The animals looked very healthy and I was totally umpressed.
Excellent experience - once in a lifetime!
Saw lots of caribou.
Excellent outfitter - good caribou numbers.
took a nice archery bull caribou, met some great people in camp. I wish it were possible to hunt for grizzly bear in this area!!
Excellent outfitters - well managed with a great conservation program. I have been doing outfitting hunting for 25 years - this is the best!!
XXX is excellent and one of the best camps I've even been to. XXX and XXX are exceptional people.

Appendix D.

A summary of the 2010 voluntary hunter comments broken down into specific topics.

No. of hunters reporting	No. of hunters mentioning good quality hunts	No. of hunters mentioning abundance /quality of animals	No. of hunters mentioning grizzlies	No. of hunters mentioning wolves	No. of hunters mentioning Park expansion	No. of hunters mentioning bad weather	No. of hunters mentioning fee increase
159	87	42	20	3	7	5	21

Appendix E.

Number, age, and horn length measurements of Dall's sheep rams harvested by non-resident hunters in the Mackenzie Mountains, 1967-2010. Number harvested includes [1]10, [2]2, [3]6, and [4]8 harvested by resident hunters.

Year	Number of Sheep Harvested	Age (Years)		Length of Right Horn	
		Mean	Sample Size	Mean (cm)	Sample Size
1967-1968	223	8.4	Unknown	86.4	168
1969	110	-	-	-	-
1970	94	-	-	-	-
1971	88	-	-	-	-
1972	110	8.5	96	86.2	90
1973	89	8.9	86	84.4	88
1974	93	9.2	85	88.6	91
1975	129	7.6	67	84.6	127
1976	144	7.8	46	88.0	144
1977	132	5.7	69	86.8	132
1978	187	8.5	115	88.9	165
1979	200	8.7	108	90.7	159
1980	180	-	-	89.9	127
1981	187	8.1	101	93.7	157
1982	126	8.7	98	89.7	124
1983	100	9.0	80	90.9	94
1984	102	8.4	98	91.2	99
1985	123	8.1	115	89.7	112
1986	154	8.8	132	88.4	153
1987	148	8.9	148	89.4	148
1988	177	9.8	166	91.7	161
1989	207	9.9	199	90.4	203
1990	219	9.8	200	90.2	218
1991	170	9.7	161	89.1	170

Appendix E (cont.)

Number, age, and horn length measurements of Dall's sheep rams harvested by non-resident hunters in the Mackenzie Mountains, 1967-2010. Number harvested includes [1]10, [2]2, [3]6, and [4]8 harvested by resident hunters.

Year	Number of Sheep Harvested	Age (Years)		Length of Right Horn	
		Mean	Sample Size	Mean	Sample Size
1992	203	9.7	199	88.0	202
1993	191	9.7	181	87.6	190
1994	199	9.5	191	89.8	196
1995	190	9.7	189	89.3	189
1996	201	9.5	200	88.7	201
1997	210	10.0	206	89.9	203
1998	215	10.0	207	90.0	209
1999	204	10.2	183	88.8	184
2000	189	10.0	189	89.5	189
2001	199	10.0	188	87.7	189
2002	173	9.9	166	89.2	166
2003	213	9.7	210	89.8	212
2004	201 [1]	10.0	199	89.3	200
2005	203 [2]	10.2	196	89.4	199
2006	208 [1]	10.4	206	88.4	207
2007	216 [3]	10.8	216	88.3	216
2008	192 [4]	10.6	192	88.8	192
2009	179 [3]	10.9	178	88.2	178
2010	193 [4]	10.8	191	88.7	192
Mean 1972-2010	173	9.0	154	89.0	166

Appendix F.

Outfitted non-resident hunter harvests in the Mackenzie Mountains, 1991-2010. Number harvested includes [1]10, [2]2, [3]6, and [4]8 harvested by resident hunters.

Year	Number of Licences Sold	Number of Animals Harvested						
		Dall's Sheep	Mountain Caribou	Moose	Mountain Goat	Wolf	Wolverine	Black Bear
1991	354	170	179	40	6	14	3	0
1992	364	203	142	32	5	7	0	0
1993	382	191	191	56	9	7	3	0
1994	356	199	164	46	5	15	2	0
1995	344	190	180	49	6	14	1	0
1996	387	201	175	46	4	11	4	0
1997	352	210	168	44	2	17	1	0
1998	345	215	160	52	5	9	0	0
1999	321	204	117	36	1	11	3	0
2000	332	189	127	44	1	14	0	0
2001	332	199	132	47	2	15	2	0
2002	338	173	168	42	5	11	1	0
2003	347	213	143	48	6	12	0	0
2004	337	201 [1]	135	55	6	18	0	0
2005	394	203 [2]	160	75	18	19	1	0
2006	407	208 [1]	188	72	12	23	1	0
2007	405	216 [3]	165	74	21	12	0	0
2008	399	192 [4]	167	75	21	17	1	2
2009	339	179 [3]	125	59	20	20	3	1
2010	384	193 [4]	158	75	13	19	3	0
Mean 1991-2010	361	197	157	53	8	14	1	0

Appendix G.

Summary of age and sex ratios calculated from non-resident hunter observation reports in the Mackenzie Mountains, 1995-2010.

Year	Dall's Sheep		Mountain Caribou		Moose	
	Lambs: 100 Ewes	Rams: 100 Ewes	Calves: 100 Cows	Bulls: 100 Cows	Calves: 100 Cows	Bulls: 100 Cows
1995	67	82	36	34	30	95
1996	44	82	45	40	26	76
1997	57	55	36	21	30	107
1998	60	84	36	34	30	95
1999	58	90	43	25	20	100
2000	47	90	41	39	26	89
2001	59	89	56	61	28	120
2002	58	89	59	31	29	96
2003	50	83	39	36	25	129
2004	53	93	42	38	30	101
2005	51	98	42	42	33	110
2006	53	96	43	37	33	137
2007	64	83	52	37	36	101
2008	49	98	41	40	31	115
2009	55	94	45	39	31	90
2010	49	93	45	46	35	101
Mean 1995-2010	55	87	44	38	30	104

Appendix H.

Summary of age and sex ratios calculated from non-resident hunter observation reports of mountain goats, 2002-2010.

Year	Kids:100 Nannies	Billies:100 Nannies	Total Animals
2002	55.2	75.9	69
2003	61.5	70.5	182
2004	57.1	77.1	84
2005	66.0	50.4	306
2006	61.5	51.4	245
2007	71.2	57.7	393
2008	54.3	97.1	264
2009	64.6	59.0	327
2010	78.3	46.2	239
Mean	63.3	65.0	234.3